The FOUNDRY

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Castings Support Markers for Directing Traffic

EACH year, as the automobile production record is broken and plans are laid for a greater output of passenger cars, the problem of regulating traffic and protecting both the pedestrian and the automobile driver becomes more acute. The loss of life by automobiles in this country has become appalling and has placed the responsibility before the American people of providing some means for curbing this national casualty list. Progress is being made in solving the problem of safety and various types of equipment are being used to direct the ever increasing motor car traffic, some of which have been described previously in this column. Recently a new type of traffic marker has been developed to take the place of paint which is used commonly in pavement writing, guide lines, etc. As in the case of many other appliances employed to direct traffic, the foundry plays a prominent part in supplying materials for the construction of this new type of marker. The device resembles a large thumbtack, with a substantial cast iron base which is sunk into the pavement and a button like head of monel metal which is raised slightly above the pavement at the center and gradually slopes to the pavement level.

Courtesy National Traffic Appliance Corp.
Castings Anchor the Marker in Chicago's Busy Thoroughfares

Find Where Castings May Be Sold

CONTENTS

SPECIAL FEATURES

	Page
Catch 'em Young, Treat 'em Well, Tell 'em Every Thing Is Ford Receipe	203
High Temperatures Obtained in Small Open Hearth—By Henry G. Begeman	209
Reduction of Defects in Steel Castings Requires Co-operation—By R. S. Munson	211
Control Aluminum Temperature—By Kirtland Marsh	213
Mold and Sand Handling System Attains Economies—By R. J. Heiserman	217
Plan Program for Visitors	221
Micr oscope is Useful Adjunct in Nonferrous Investigations—By J. S. Glen Primrose	222
Bill Glances Back Over the Years—By Pat Dwyer	228
Designs Loose Pattern Parts—I—By Joseph G. Horner	233
Restore Molding Sand Bond—By Walter F. Prince	236
Patternmaker's Gouge a Major Turning Tool—By Walter C. Ewalt	238

REGULAR DEPARTMENTS

How and Why in Brass Founding — By Charles Vickers	227	**Comings and Goings of Foundrymen**	244
What Others Are Thinking	241	**Foundry Association Directory**	245
The Shakeout	242	**What the Foundries Are Doing**	248
Trade Trends in Tabloid	243		

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Catch 'em Young

Tell 'em

"If a man can write a better book, preach a better sermon, or make a better mouse trap than his neighbor, though he build his house in the woods, the world will make a beaten path to his door."

ACCORDING to popular report Henry Ford has discovered the little country school in the East famous at one time as the rendezvous of Mary and the Lamb. He has repaired it, restored it to its original condition and converted it into a kind of a shrine dedicated to the memory of the sturdy and virile young boys and girls who were thrown on their own resources for an education after spending a few years in absorbing the elements in the little red school house with green shutters.

This is a comparatively unimportant incident and yet, because it seems to indicate the possession of a sentimental nature in a man who once was quoted as saying that history is all bunk, it has been given newspaper space and comment from one end of the country to the other.

In the meantime a remarkable school conducted along the original lines that characterize Ford's methods in handling any kind of a problem has been functioning at the Highland Park plant of the company for the past ten years and few people outside those directly interested have heard of its existence.

This school is no little 10 x 20-foot frame building with 23 pupils and a prim school ma'am slowly wearing her life out hammering the rudiments of the three R's into succeeding generations of careless and irresponsible youngsters. The Henry Ford Trade school at present has an enrollment of 1800 and a waiting list of 4000. The staff of instructors is approaching the 150 mark. The school covers an area of three acres and on one floor the series of rooms 70 feet in width extend for a distance of 1400 feet.

Equipment in these rooms is valued at $1,000,000 and includes hundreds of the finest and most modern machines. This shop is divided into 18 departments and two men spend their entire time moving boys from one department to another as fast as they have completed the required assignment. An accurate record is kept, not merely of the department in which the boy has worked, but also of the various operations he has performed in each department.

Another radical point of difference between this school and others is that the students are paid for their time. They punch a time clock like regular workmen. Henry Ford is opposed to all forms of charity in industry. He believes that any form of charity, of giving something for nothing kills initiative, independence and the spirit of confidence that is the birthright of a free people. He claims that every man should be encouraged to produce to the maximum of his ability and that he should be paid accordingly. He is willing to provide the opportunity for the man or boy and also is willing to recompense him fully for his services.

Believes In Practical Work

One of the auto king's theories in regard to modern educational methods, so far as they relate to the great bulk of the population destined to enter the industrial field, is that it is nearly all wrong. The trade school which he has established in Detroit seems to prove that in this as in many other of his departures from accepted beliefs he is right; tradition and recognized custom and practice to the contrary notwithstanding.

After the age of 12 he claims that a boy's time in the orthodox type of school largely is wasted.

Treat 'em Well in Everything

[Is Ford Recipe]

In addition to his academic lessons he should be given the opportunity of contributing his share to the aggregate of the world's work. He should be trained to take his place in the great wheel of industry and incidentally taught lessons of thrift, application and a legitimate pride in his skill as a master craftsman.

Opens Opportunity's Door

After the school period is over, boys are given the opportunity of entering the Ford shops in any capacity for which they are fitted, but there is no compulsion. No strings or obligatory clauses of any kind are attached to the course of study. No contract form of any kind is entered into. The boys are free to leave at any time and the company is free to dispense with the service of any one at any time it sees just cause.

The entire arrangement is based on a just and a common sense basis. Boys are recompensed liberally for their time and services and the work is arranged in such a manner that the institution practically is self-supporting.

Although the entire transaction is carried on a cash basis and in as matter-of-fact a manner as that pursued in the manufacture and disposal of the immense output of the Ford factories, still a vein of sentiment underlies the foundation of the institution and is interwoven with the warp and woof of its operation.

One of the original causes for the founding of the school was a desire on the part of the founder to provide boys in indigent circumstances with the opportunity of becoming self-sustaining and respectable members of society. Applications only were received from orphans, from sons of widows or from boys whose parents were in no position to care for them in an adequate or even nearly adequate manner. Also the age limit was placed between 12 and 15 years.

Today even as ten years ago when six boys and one instructor began the experiment, needy boys are given the preference. Orphan boys constitute approximately 10 per cent and widows' sons 45 per cent of the total enrollment. Fully 80 per cent of the boys in attendance must help to support themselves. On account of the strong appeal to local boys, resulting in a waiting list of 4000, applications are not accepted from other towns or cities in the United States or elsewhere.

The main school building adjoining the office of the Ford Motor Co. at Highland Park, originally was an orphan asylum. A sufficient sum was paid for the purchase of this property to enable the asylum authorities to erect a much larger institution on a large tract of land in another section of the city.

Propose Larger School

Gradually, as the enrollment increased, additional departments were added until now, as stated previously, the class rooms and rooms devoted to executive, industrial and recreational purposes, cover an area of three acres. Preparations are under way for a second school to be establshed at the Fordson plant which will be conducted on a much larger scale. Also in line with the company's policy of constant improve-

Shop and classrooms for the 1800 students cover an area of three acres. On one floor the rooms 70 feet in width extend for a distance of 1400 feet

ment in methods and processes, it is claimed that it will present many new features.

Upon entering the school a cash scholarship amounting to $7.20 per week is awarded to each boy. He is paid on the 5th and 20th of each month throughout the entire year, including a vacation period of three weeks in the summer and one week at the Christmas season. He is docked for any time he may lose wilfully. The company uses its own discretion in carrying boys who may lose time through causes beyond their control. In certain instances the boy not only has been kept on the roll, but his medical and hospital expenses have been paid by the company.

The school is incorporated under a statute of the state of Michigan to operate without a profit. The only academic requirements for entrance is that candidates between the ages of 12 and 15 must be in the same grade as the majority of boys of their own age.

Course of instruction is divided into two parts, academic and shop work. Here, also the methods in use differ radically from those employed elsewhere. Class work only occupies one-third, while shop work takes up two-thirds of the time. Thus the boy spends one week in the class room and two weeks in the shop under actual production conditions. As a result of ten years' experience under the insistent drive of a man constantly seeking higher standards of simplicity, and efficiency, it is claimed this method of alternating the class and shop time is the most satisfactory.

At the close of each six-week period a report is submitted covering the shop and class work of each boy. Two marks on these reports indicate the instructor's estimate of the boy's industry and conduct in both departments. If both marks are good the boy is given an increase of 40 cents per week. When the $10 a week rate is reached a third mark is placed on the boy's record to indicate the character of the work which he has been doing in the shop. So long as the three marks remain favorable the boy automatically continues to receive the 40-cent increase at the beginning of each new six-week period. A boy who applies himself diligently should be earning $12.80 per week at the close of the second and $16 a week at the close of his third year.

Starts a Bank Account

By the time a boy is 17 years old, he should have a scholarship rating of $18 per week. This is the maximum amount awarded until a boy is 18 when he completes the junior course.

To help the student develop the habit of thrift and to familiarize him to some extent with the atmosphere and customs of banks he is given $2 each month in addition to what he gets through his scholarship. This extra money must be deposited in some bank and kept there so long as the boy remains in the school. Bank books are brought to school and submitted for inspection every month.

Every student is given a free hot lunch at noon. This with the two cash payments brings a boy's minimum yearly earnings up to $450 and the maximum earnings up to $1020. With the present enrollment the fund devoted to scholarships amounts to $1,000,000 a year.

The entire academic course taken up during the junior apprenticeship period covers twelve subjects includ-

Foundry Is Real Shop

IN THE foundry department of the Henry Ford Trade school the boys are given an intensive, all-around training under actual production conditions. The foundry department is located on the top floor of the building to secure ample light and ventilation. The cleanliness which characterizes every department of the Ford institution is maintained here to an almost unbelievable degree.

Equipment is provided for the production of a wide range of small and medium size castings in iron, brass and aluminum. Boys are taught how to make the molds and melt the metal under the most modern methods. Molds are made on the floor, on the bench and on several squeeze and jolt machines. Brass and iron are melted in electric furnaces and aluminum for both sand and die molds is melted in an oil-fired furnace.

In a large and well equipped laboratory in another department, the boys practice qualitative and quantitative analysis and are taught how to make photomicrographs. Supplementary work in related subjects including the theory of shop management and production are taught in the class rooms under competent instructors.

ing: Algebra, arithmetic, auto mechanics, chemistry, civics, commercial geography, English, geometry, mechanical drawing, metallography, metallurgy, physics, qualitative analysis, quantitative analysis and shop theory.

Many of the boys who contemplate a college course later, are taking history and foreign languages in other schools in the city. Boys come to school at 7:30 a. m. five days a week and remain until 3:55 p. m., on the days they work in the shop. On class days they are dismissed half an hour earlier and credited with a full 8-hour day.

School activities are not confined exclusively to the shop and class room. During the class week, one period each day is devoted to supervised athletics. The school is represented by several teams in the scholastic athletic circles of the city. A creditable orchestra is maintained and the school dramatic association has acquired quite an enviable reputation. Twice a month the boys get out a creditable school paper known as *The Artizan*.

Many Departments

In the beginning a new boy is placed on a machine set to do one simple operation. He is kept at this one job until he becomes in a measure accustomed to machinery and his surroundings. Later he is transferred to work on a shaper, lathe, milling machine, grinder and bench. So far as possible boys also are given an opportunity to work in the following departments: Carpentry, car repair, die, forge, foundry, gage, hardening, nickel plating, sheet metal, tool repair, valve repair, wood and metal pattern.

Each job in the shop is done on a work order. An expert estimates the time a skilled mechanic would require to complete the job. An accurate time record is kept and boys and instructors try to come within the estimate. Over a period of several years the excess time has varied within a comparatively wide range. For example the peak maximum was 60 per cent, while the minimum achieved in September, 1926 was 13 per cent. The average time for the boys is about 25 per cent greater than the estimated time for skilled men.

Scrap loss averages 4 per cent which is about the same as that in the ordinary tool room. No work is done merely for practice. Unless spoiled in the making, everything the boys make is used. Wherever possible, even in the class rooms, practical work is done by the boys Mechanical drawing instruction is given during the entire course. Many of the older boys under the direction of instructors carry on development work for the Ford Motor Co., for which the school is credited.

Average annual value of material produced by each boy is approximately $1000. From this it is apparent that the income from work done for the Ford Motor Co., amounts to $1,800,000 a year. This sum is sufficient to pay the students scholarships, salaries for instructors and all upkeep on equipment. It does not pay any interest on investment in buildings and equipment.

Maintain Ideals

Cleanliness, safety, and accuracy in the order indicated constantly are held up as ideals before the boys during the entire training period. The slow but sure attitude is regarded as a relic of a bygone age. Accuracy is essential, but it must be coupled with speed, therefore speed is held up as the fourth ideal. Ingenuity, the ability to develop better methods, to turn out a better product is regarded as the fifth most important ideal.

Boys are encouraged to develop their own initiative and not to rest satisfied with what is shown them by their instructor. If a boy has the creative or inventive instinct, the school affords him every encouragement to develop it along individual lines without interfering with his regular standing.

At 18 the boy enters the senior course. He works 8 hours in the shop each day and attends class work in advanced drafting and mathematics 4 hours each week. His rate gradually is increased to $30 a week by the time he is 19 and may reach $40 a week by the time he is

One section of the main shop floor where boys are taught how to operate various types of machine tools

20. At this age and sometimes before he is offered a position in one of the many departments of the Ford Motor Co. Many former graduates already are holding important positions.

In addition to the Henry Ford Trade school, the Ford Motor Co. conducts other educational work under an organization known as the Ford School of Technology which is incorporated to operate without profit. Apprentices are trained to become highly skilled mechanics and special students are given a course in the construction, upkeep and repair of Ford products.

For several years several hundred young men between the ages of 20 and 25 have received special training in the tool rooms of the company with a view to becoming highly skilled toolmakers with a special knowledge of the equipment and methods in vogue. They are classed as special apprentices and spend a period of 3 years working with skilled toolmakers under production conditions. They are looked after by a special foreman in each toolroom who advances them from point to point and from machine to machine as fast as they master the details and show proficiency.

They are paid a starting rate of $6 a day and the rate gradually is increased until by the time the apprentice has finished the course he is receiving compensation at the rate of $8 a day. For the first two years of the training period, or for a longer period if necessary, the special apprentice must attend one class each week in mechanical drawing and one in mathematics. All class work for these students is carried on either before or after working hours and for this time they receive no pay. At present nearly 2000 of these apprentices are at work in the Highland Park and Fordson plants of the company. On completion of the course the graduates remain in the toolroom until transferred to some other department. It is from these specially trained men that the company recruits its foremen and specialty men.

Courses in electricity, metallurgy and metallography are conducted for the benefit of employes engaged in work where a knowledge of these subjects would be helpful.

From practically every country on earth letters pour in seeking permission for the writers or their sons to enter the plant as special students. Partly as a courtesy to the country they represent and partly in the hope that men so trained may be an asset to the company later, the Ford Motor Co. has placed over 300 special students in training. They come from more than 30 different countries. Many are graduates of colleges or technical schools. The spirit in which most of them come is one of service to their country. They seek those things in American industry which profitably may be applied in improving conditions in their native lands.

The United States department of labor recognizes the Ford School of Technology as an education institution and permits the enrollment of foreign students without any regard to the immigration allotment quotas. The course covers a period of two years or more. The men spend some time in the various manufacturing departments, but the greater part of their time is spent in the assembly and repair divisions.

For the majority of students this is their first experience in a factory. Many who come from countries where manual labor of any kind is considered degrading, are forced to change their entire mental viewpoint. As their muscles harden and their viewpoint changes their discouragement vanishes while their enthusiasm based on a surer and firmer foundation remains. So long as a student remains in that class he is paid at the rate of $6 a day.

At present natives of the following countries are on the student payroll: Armenia, Australia, Brazil, Canada, Chile, China, Colombia, Costa Rica, Cuba, Czechoslovakia, Denmark, Egypt, Finland, France, Germany, Greece, Guatemala, Holland, India, Japan, Jugo-Slavia, Mexico, Norway, Panama, Persia, Philippine Islands, Poland, Porto Rico, Portugal, Russia, Scotland, Spain, Sweden, Switzerland, Turkey.

About 25 years ago the University

(*Concluded on Page* 235)

The foundry is located on part of the floor above the power house which accounts for the large pipe in the center of the illustration. Everything is kept clean and the boys wear safety appliances when handling molten metal

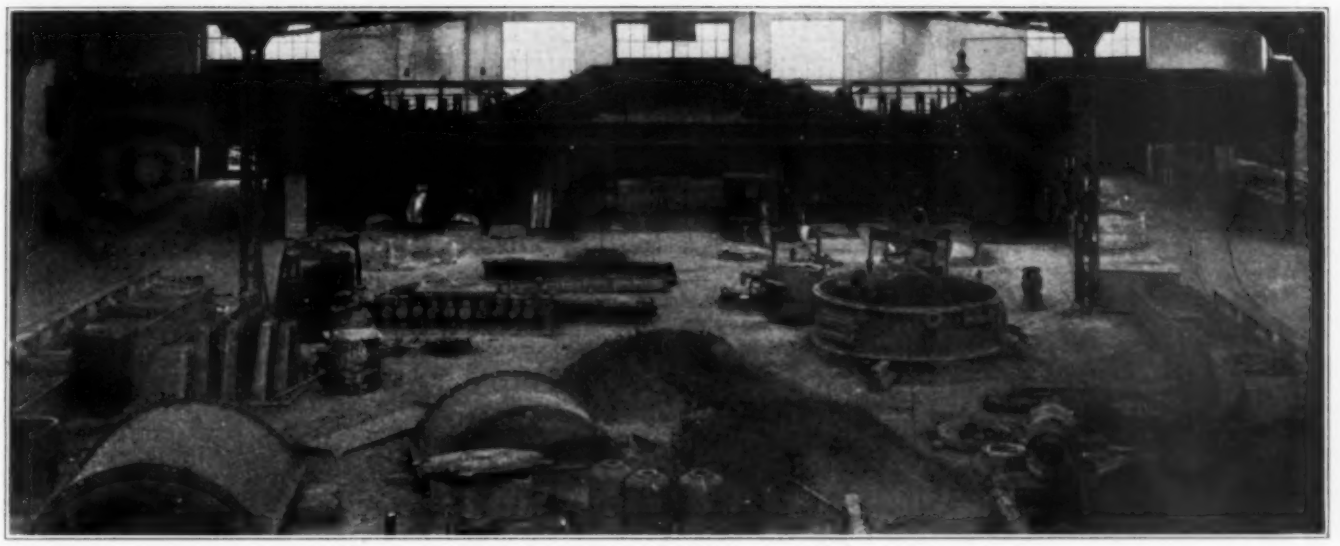


Fig. 1—View of a Two-Furnace Installation in an Austrian Foundry. Castings in the Foreground Are Typical Steel Castings Poured fr om these Furnaces

High Temperatures Obtained in Small Open Hearth

By Henry G. Begeman

IN THE manufacture of thin walled castings and alloy steels, the factor of a high furnace temperature is important. Temperatures cannot exceed a certain point in the ordinary open-hearth furnace due to the danger of roof failure caused by melting or fusion of the roof brick. The necessary high temperatures may be attained in the electric furnace, but unless power is cheap, higher prices must be obtained for the product.

Efficiency of operation and high temperature are stated to be obtained by incorporating the gas producer into the body of the furnace. The steeply pitching air ports are claimed to cause the flame to be deflected from the roof and upon the metal bath. The author is a consulting engineer in Philadelphia.

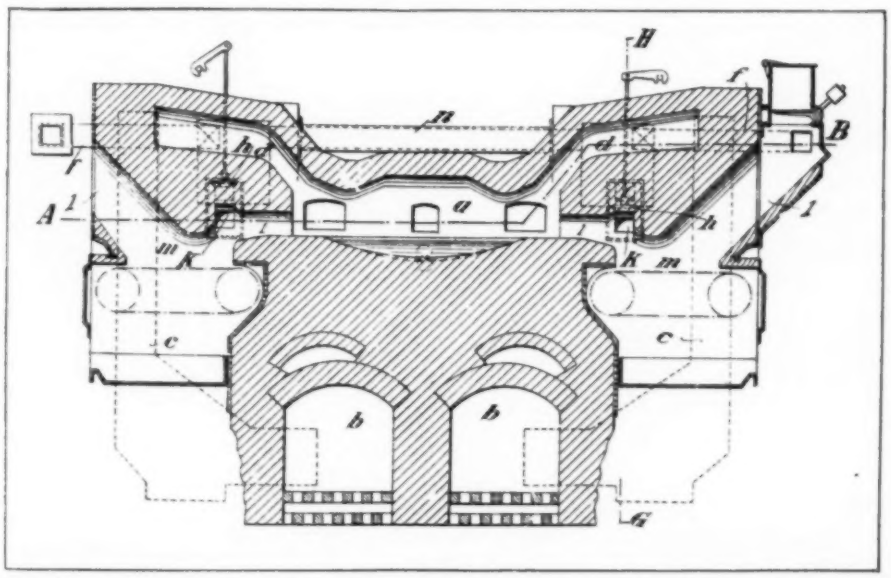


Fig. 2—Diagram Showing the Details of the Furnace. The Air Port is Located at the Top and the Gas Port Beneath

Several different types of small, open-hearth furnaces suitable for steel foundries have been developed which operated with more or less success. Earlier types followed the regular open hearth principle with regenerators and were fired with gas, oil or producer gas from a separate unit. Recently a new furnace was developed which differed radically from the other types in that gas producers were incorporated into the body of the furnace itself, one at each side.

One of this type was described on page 88 of the Feb. 1, 1926 issue of THE FOUNDRY. More recently a furnace along somewhat similar lines was developed by Peter Ostendorf of Vienna, Austria. This, it is claimed, works with excellent results in an Austrian steel foundry in making various kinds of steel. Fig. 1 shows the installation of two furnaces in line in this foundry. In the foreground may be seen a number of castings poured from steel melted in this furnace.

Integral gas producers are built in both ends of the furnace and the hearth of the furnace is connected with the high temperature or gasification zone of the producers, as shown in Fig. 2 so that the radiant heat of this zone acts directly upon the hearth space and increases its temperature. The essential difference

between this new open hearth furnace and others is that there are but two ports, a gas port and an air port at each furnace head. The connecting duct between the white heat zone of the gas producer and the hearth space is made to serve not only for the direct transmission of the heat from this zone to and into the furnace hearth, but also leads the heating gases into the hearth. This promotes the direct utilization and exhaustion of the gasification heat for increasing the furnace hearth temperature.

With this design the temperature of the gas, which is mixed in the gas port with the products of combustion formed in the gas producer, is increased considerably as it is exposed to the high temperature of the gasification zone. Due to this arrangement, temperatures over 3300 degrees Fahr. may be reached in the furnace. This makes it possible to pour steel castings with extremely thin walls from 1/16 to ⅛-inch thick and with sharp edges.

Furnaces are built in capacitites from 1 to 3 tons so that castings up to 4500 pounds may be poured. With a charge of about 2 tons, it is claimed that 6 charges may be made in 24 hours if good gas coal is used with an average fuel consumption of 0.4 pounds of coal per ton of steel. In one of the furnaces shown in Fig. 1, it was said that 10 charges a day from 3000 to 3500 pounds each were made. The fuel consumption was about 23 per cent by weight, the heating value of the coal being 13,788 B.t.u. per pound. Tests made with specimens from 45 charges showed an average tensile strength of 73,240 pounds per square inch and an elongation of 22.1 per cent.

These furnaces also have been used for making special alloy steel, and it is claimed that considerably cheaper raw materials can be used than in the crucible steel process. Up to 90 per cent of the charge may be hard or soft steel scrap with the necessary addition of pig iron for producing a steel which is as tough and elastic as crucible steel, but with the ordinary charge, exceeds the latter in tensile strength. The furnace is said to be operated safely and may be regulated closely.

Number Ordered Governs Type of Pattern

Question: I have been asked to quote an estimate on the cost of making castings like the accompanying sketch. I shall appreciate your opinion on the best way to make the pattern and the mold. I am not familiar with light thin work of this character.

Answer: The best type of pattern for the casting shown in the sketch, will depend on the number of castings ordered. For a limited number a well constructed wood pattern will yield satisfactory service. For a large number, or if the pattern is to be mounted on a machine, a metal pattern will prove most economical. In addition to the usual nails and glue it is advisable to use any one of several types of corner joints practiced in the wood working industry. A simple check joint will serve satisforctorily, while a dovetail joint will lend additional security. A lap joint on the corners of the web strips will add to the strength of the pattern. Four rapping plates, two on each side on the upper side of the web, will furnish a means for rapping and drawing the pattern. As an alterntive measure the draw plates may be attached to the inside of the web. A hole bored through the wood above each one will permit the entry of the draw screw. In this instance the plates are not used for rapping plates. The pattern is rapped on three stopoff pieces that are used to bind the side members together and to prevent them from warping. Tail prints are attached to the outside of the pattern and a special corebox is provided to save the time usually emplyed in stopping off pieces of stock core. The pattern is placed on a good flat board in the position shown in the sketch and the drag is rolled over. If the mold is rammed by hand a single pattern will serve for both cope and drag. If a machine is employed a separate plate will be required to form the machining strips on the cope side.

British Foundrymen To Hold Meeting

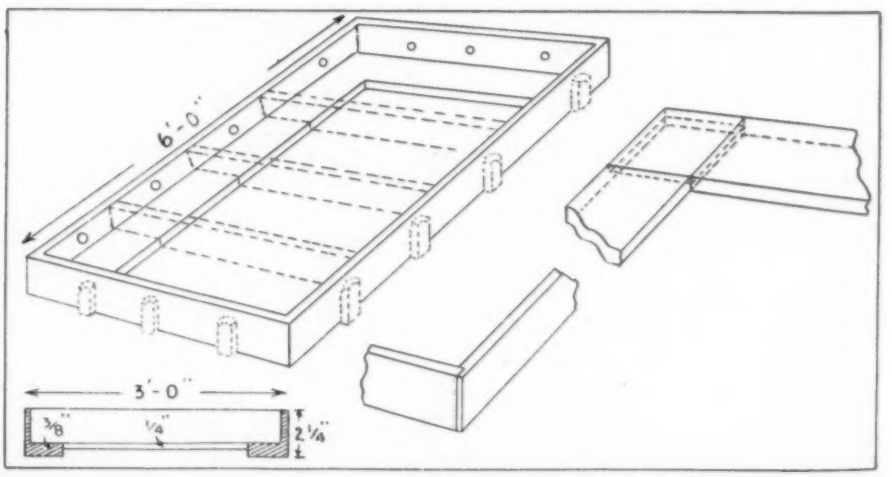
A program of 11 papers has been arranged for presentation at the annual meeting of the Institute of British Foundrymen which will be held in Sheffield from July 5 to 8. The titles of the papers and their authors are as follows:

Importance of Air Control in Efficient Cupola Practice, by P. H. Wilson; the Properties of Coke Affecting Cupola Melting of Steel, by J. T. MacKenzie (American Exchange paper); the Influence of Chromium and Nickel on High Quality and Heat Treated Cast Iron, by Professor Piwowarsky; High Test Cast Iron, by F. M. Robbins; the Influence of Chromium and Nickel on British and American Cast Irons, by T. H. Turner and A. B. Everest; the Strength of Cast Iron, by J. E. Fletcher; the Manufacture of a Large Steel Casting, by F. A. Melmoth and T. Brown; Strains in Nonferrous Castings, by Dr. Desch; Malleable Cast Iron, by E. R. T. Taylor; French exchange paper, by M. Audo; Belgian exchange paper.

The first two papers will be discussed together. Papers three to six also will be discussed together. The presidential address will be delivered by J. T. Goowin.

Builds Big Transformers

The General Electric Co., Schenectady, N. Y., is building in its Erie, Pa. shops three of the largest capacity transformers ever built for use in connection with electric steel melting furnaces. These transformers will operate on a 22,000-volt, 3-phase, 60-cycle circuit and have a continuous rating of 7500 kilovolt amperes.



PERSPECTIVE VIEW OF PATTERN WITH DOTTED LINE SHOWING JOINTS, TAIL CORE PRINTS AND STOPOFF BARS

Reduction of Defects *in Steel Castings* Requires Co-operation

By R. S. Munson

DEFECTS in steel castings considered in this paper are not only those serious enough to cause scrapping of the casting, but also minor defects which can be repaired satisfactorily, though at an added cost. This problem of defects is an ever-present one with each steel foundryman, and together with cost and deliveries, both of which it affects vitally, are the daily bane of his existence.

Theoretically, if one perfect casting can be made from a pattern it should be possible to make any number of perfect castings from the same pattern. How difficult to achievement this is, is borne out by the daily experience of any steel foundry. Castings made from the one pattern by the same molder at the same time, and poured from the same heat, will show varying individual defects often hard for the foundryman to explain.

A few years ago an article by Michael R. Burns appeared in THE FOUNDRY, entitled "Fifty Causes of Defects in the Foundry." In this paper the author enumerated in detail fifty causes of defects. He stated further that, in view of the almost innumerable possibilities of defects in a casting, the wonder is not that there are so many defective castings, but rather that the percentage of good castings is as high as it is.

Remedies May Differ

It is not the purpose of this paper to enumerate all the defects which do or may occur to steel castings in the foundry, nor to attempt to offer remedies for each individual defect, for these remedies may differ as much, according to the individual judgment of different foundrymen, as the defects themselves.

For example, a shrinkage crack in a casting may be remedied by the changing size or location of heads, using brackets or cracking strips or by the use of inside or outside chills, any one of which may solve the trouble. The method used depends entirely on the judgment of the foundry foreman.

Speaking generally, however, the causes of defects in steel castings in the foundry can be placed under three main heads:

1. Design and pattern equipment.
2. Molding and core shop methods.
3. Melting and pouring conditions.

These causes are mentioned in their sequence in the cycle of operations, and will be considered in that order.

In the matter of design, especially in the jobbing foundry, the steel foundryman is often the unwilling and unhappy victim, since most of the castings he makes are designed by his customers, and in many cases the engineer in his effort to limit weight or decrease assembly costs designs a casting not consistent with good steel foundry practice. Most steel foundrymen could cite instances from their own experience where, after suffering heavy losses in the foundry from castings of this character, they have made changes in the original design, in order to conform to good steel foundry practice, by which they have been able to produce satisfactory castings without great loss from defects. This of course, does not apply to experimental work, where the customer is trying to develop a design with the assistance of the foundry, but rather to the regular run of work which the steel foundry concerned has taken at a fixed price and on which they expect to make a profit. Nor does it apply to the foundry making specialties of their own design where the engineer has taken steel foundry problems into consideration.

In order to reduce the defects from this cause the steel foundry should insist that its customer's engineers consult with them as to castings of new or intricate design. By doing this it is possible to work out the problems beforehand satisfactorily and save losses to the foundry and vexatious delays to the customers.

A somewhat similar condition prevails with pattern equipment, as in most cases this, too, is supplied by the customer without consultation with the foundry concerned as to the most suitable method of construction. A solid pattern may be supplied when a split pattern would be preferable, or the split pattern supplied may be parted wrongly. Core boxes may be supplied when it would be better for the pattern to leave its own cores, or the reverse may be the case. Blueprints may not be supplied so patterns can be checked for shrinkage, nor are patterns always marked to show finish.

The physical condition of the patterns may be such that they will not last for the order, and so cause defective castings. This question has been treated very ably in detail by W. J. Gilmore in a paper entitled "Pattern Expense from the Jobbing Foundry Point of View," presented before the Steel Founders' Society of America in July, 1926. In this paper the author showed clearly and definitely the losses to the steel foundry from poor pattern equipment furnished by customers and accepted by the foundry.

Recommends Standard Patterns

If all customers could be convinced of the advantages to themselves, as well as to the steel foundries, of constructing their patterns in accordance with the standard method sponsored by the American Foundrymen's association, the Steel Founders' Society of America and other foundry organizations, many of the difficulties mentioned would be overcome. To accomplish this it is necessary for the foundries to co-operate whole-heartedly in educating customers along these lines.

Too often in anxiety to secure an order the question of design and

Points the Way

ONE foundryman has stated that in view of the almost innumerable possibilities of defects in a casting, the wonder is not that there are so many defective castings, but rather that the percentage of good castings is as high as it is. Poorly designed patterns, improper heading and gating, warped flasks and unsuitable sand all help to produce defective castings and raise foundry costs. In this article, which is abstracted from a paper presented at the convention of the American Foundrymen's association held in Detroit, the author points the way to obtain better results in the steel foundry. Mr. Munson is vice president of the Atlantic Steel Castings Co., Chester, Pa.

proper pattern equipment will be overlooked and the foundry securing this order finds itself facing the problem of producing castings of impracticable design from poor pattern equipment without sustaining severe losses from defects due to either or both of these causes.

When a pattern of proper design and construction is ready for production the first problem of the foundry and core shop foremen in securing a satisfactory casting is that of proper heading and gating. This calls for their best judgment, as from this point on each casting becomes an individual problem and any mistakes in heading and gating will cause similar defects in each casting, in addition to whatever individual defects they may fall heir.

If heads are too small shrinkage will develop, if too large metal is wasted and the large head may crack the casting. If not properly gated, scabby, misrun or cracked castings may result. As this is so much a matter of individual judgment on the part of the foreman, and, as his judgment is based largely on his previous experiences with castings of similar design, it would seem advisable to help him by keeping a careful record of previous methods, both satisfactory and unsatisfactory, rather than forcing him to rely entirely on his own memory. With the benefit of this previous experience definitely placed before him he is in much better position to avoid defects in the castings arising from mistakes.

It seems unnecessary to mention the need for good flask equipment, but due to the hard usage to which flasks are subjected in a steel foundry, particularly those flasks used for dry sand, it is not unusual to find flasks in such condition that they are the cause of various defects in the castings. Warped flasks with bad joints and poor pinholes may be seen in daily use, resulting in shifted, crushed or heavily finned castings.

With proper pattern equipment to place in suitable flasks, the next problem for the foremen is that of a proper molding and core sand. Each steel foundry, no doubt, uses the most suitable sands and clays for their class of work which are obtainable in their particular locality. It is essential, however, that this sand be conditioned properly both for use in molds and cores, with particular reference to the character of the castings to be made. Which is the best sand or combination of sands to be used, can be decided only by results obtained. Once this is determined the sand should be kept to these standards, not only from day to day, but from hour to hour in order to insure the uniformity desired. This can best be done by laboratory equipment, for the old method of testing by the "feel" will cause too wide variations. The moisture content, permeability and strength of the sand should carefully be determined. This will vary of course, depending on whether the sand is used for green sand or dry sand molds, also on the size of the casting to be made. A green sand too wet or too close will cause blowy or scabby castings, one too dry, dirty castings. A dry sand too wet will cause cracked molds in drying, with the possibility of dirty castings. A sand too strong will make too hard a mold, which will crack the casting; one too weak will result in crushed or dirty castings.

In dry sand work burned molds or molds not thoroughly dried also will cause some of the defects mentioned. Considering the great number of defects in steel castings, which are traceable directly to poor sand conditions, it is evident that a great deal can be done in the way of improvement of conditions along these lines.

While the sand committees of the American Foundrymen's association have done valuable work in sand investigation, it would be possible for individual foundries in adjoining localities using the same source of supply to extend this work with great practical benefit to themselves. By co-operating more closely in determining the best sands available, and also the best methods of conditioning them they should be able to materially reduce defects from sand conditions. It would seem that there are great possibilities for further research.

Proper Methods in Molding

With the use of the best equipment and raw materials the foundry foreman and core shop foreman still face the task of properly making molds and cores so that when closed and poured the resulting castings will be satisfactory. This largely becomes a problem of workmanship, such as proper ramming, nailing and venting of molds and cores. As each casting is individual so is each workman, and the individual casting tends to reflect the efforts which the individual workman puts into it.

In spite of the prevalence of machine production, there is still a great need for skilled workmen. In every shop there are always certain outstanding workmen whose product is superior to that of their fellow workmen, as shown by the small number of defective castings coming from their floor. And perhaps the defective castings in a steel foundry reflect more accurately than is thought the character of the personnel of that foundry. If this be true all efforts along the line of improving the character of the personnel would be amply repaid. A good example of what can be accomplished along these lines is illustrated by the results obtained by the Milwaukee group of steel foundries with their apprentice system.

There is no doubt that this group of foundries is benefiting and will further benefit from their efforts in properly training young men for the foundry trades. This subject, which only can be touched upon in this paper, is a great problem in itself, and we are at present only concerned in its effect on eliminating defects in steel castings. Any improvement in personnel, however, brought about will be reflected in a smaller number of defective castings.

The actual making of steel in the foundry probably has received closer attention from technically trained men than has either the pattern shop or the foundry proper. Nearly every steel foundry has its own physical and chemical laboratory with a chemist or metallurgist in charge. Most of his time has been given to the metal end of the industry, which probably justifies the assumption that from a scientific standpoint it is ahead of the other operations. Yet in spite of this many defects in steel castings are directly traceable to the melting and pouring of the metal. Wild heats are not unheard of nor are all heats properly made otherwise. The pouring temperature of the metal may not be correct for the castings to be poured. If too hot, castings of certain designs may crack or the sand burn in badly. If too cold, misrun or dirty castings result.

Other defects may arise from improper pouring on the part of the ladlemen, such as strained molds from too rapid pouring, or misrun castings from too slow pouring. The melter and ladlemen should be informed as to the nature of the castings in the molds to be poured so that metal is tapped at the proper temperature and poured into the mold with due regard to its individual characteristics.

It is the proper combination of all the conditions affecting patterns, molds and metal that makes possible castings free from defects. Failure in any one of them will cause defects of varying degree. The number and extent of these defects often means

(*Concluded on Page* 232)

Control Aluminum Temperature

Detailed Description Is Presented of Several Types of Quick Reading Pyrometers, Also Hints on Prolonging the Life of the Working Ends of These Instruments

By Kirtland Marsh

FOR continuous use in melting pots or furnaces a thermocouple protected by an outer tube is satisfactory, for although considerable time is required for the protection tube and the thermocouple to reach temperature equilibrium and correctly indicate the temperature of the molten metal, once heated up, the couple follows the temperature of the molten metal with little lag and the outer protection tube reduces the frequency of thermocouple replacements. Such an arrangement would not be satisfactory for intermittent use in pots or furnaces or for measuring the temperature of the metal in pouring ladles because of the long time required for the couple to attain the temperature of the molten metal. A much quicker reading couple is required for this purpose, in fact, a couple used for taking the temperature of the metal in a pouring ladle should be capable of indicating the true temperature in a fractional part of a minute, say 10 or 15 seconds.

Fortunately, thermocouples can be made up or purchased which are capable of accurately measuring the temperature of molten aluminum quickly. One manufacturer of pyrometers furnishes a couple made up of relatively fine wire in a holder consisting of a metal tube with a magazine handle. A considerable length of each element of the couple is wound on spools in the magazine and extends through and beyond the tube a few inches; these wires are twisted together at the ends and when used the twisted ends are inserted in the molten aluminum to a depth of a few inches. Beyond the end of the tube these wires are not insulated and therefore it is a simple matter to cut off the ends whenever necessary, draw out a few more inches, twist the ends together and be ready for another measurement.

Wires Are Oxidized

Theoretically, there are several disadvantages to this type of construction: First the wires being uninsulated beyond the end of the tube are subject to attack for the full depth to which they are immersed in the molten aluminum and unless the wires are sufficiently oxidized to be completely covered with an insulating layer of oxide or scale the real hot junction will be at the surface of the aluminum and not at the twisted ends. This means that the surface temperature is being measured. When the couple is withdrawn, more or less metal will cling to the two wire elements of the couple and the next time the couple is used it should be immersed to at least the same depth or the aluminum adhering to the wires may cause a short circuit above the surface of the metal and cause a low reading of the instrument. However, this couple, if properly used, should prove quite satisfactory, for even if it does measure the temperature of the surface of the metal there should be little difference between the temperature at the surface and at a point below the surface in a recently filled ladle. The couple made of fine wire, has little heat capacity and should give a quick reading.

Details Types

IN THIS the second section of the paper of Mr. Marsh, presented at the Detroit convention of the American Foundrymen's association, the author gives a complete description of the various types of pyrometers that have been found successful in aluminum foundry practice. Close control of melting and pouring temperature is essential in successful aluminum casting.

Another quick reading couple used extensively by one company operating several foundries consists of a chromel-alumel couple insulated with asbestos to within about ½-inch of the ends of the wires, which are not even twisted together.

No. 8 Brown & Sharpe gage chromel-alumel wire is used and the insulation is that type of peculiar asbestos insulation frequently used on auxiliary lead wire. As far as known, no pyrometer manufacturer carries chromel-alumel wire in this size and with this type of insulation in stock, so it always has been necessary to purchase the wire and have it specially insulated. We believe that the peculiar character of this insulation is in a large part responsible for the satisfactory service which these couples have given. When heated, the wax on the asbestos burns off, but the remaining asbestos is tough and seems to stand up better than asbestos cord wrapped or woven around the elements.

Asbestos Insulation

The junction between the two elements of the couple is formed by the molten aluminum and a steady reading is obtained a few seconds after the couple has been immersed in the molten metal. The asbestos insulation eliminates any possibility of short circuits at the surface of the metal so that the temperature is measured as far below the surface as the couple is immersed. To hold the two elements togther short lengths, about ⅛-inch, are cut from a piece of seamless steel tubing, flattened slightly, slipped over the two wires and then formed like a figure 8 around the two wires. These rings are spaced 8 or 10 inches apart and hold the two wires together satisfactorily. The leads may be soldered directly to the couple or a thermocouple connector manufactured for that purpose may be used.

In use, the chromel-alumel elements are dissolved gradually away and the asbestos insulation gradually breaks away, but the elements and the insulation wear at about the same rate and it has been found that couples used to take readings every five or six minutes for 9 hours a day require to be cut back an inch or two only once every three days. This open junction type of couple, although quite contrary to the ordinary conception of a thermocouple, is quite as accurate when used in molten aluminum as one with a welded hot junction. It is not necessary to remove any aluminum clinging to the wires when they are withdrawn nor is it essential that they be immersed to the full length of the adhering aluminum the next time they are used as long as the asbestos insulation extends 2 or 3 inches below the surface of the metal. These couples generally are made up about 36 inches long and can be used until they are not more than 12 inches or less.

With either of these quick reading

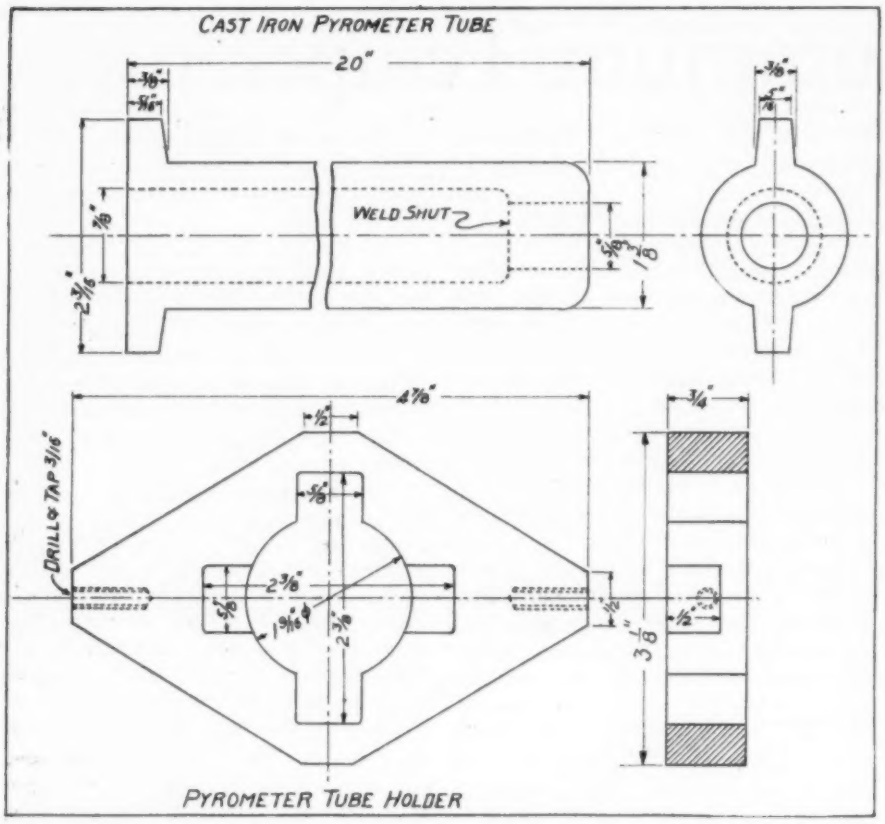


FIG. 2—CAST IRON PYROMETER TUBE AND HOLDER

couples, the temperature of each and every ladle of metal can be determined quickly and accurately and there should be no reason for any aluminum casting being poured at other than the best pouring temperature.

It is an extremely simple matter to check or calibrate either of these quick reading couples or a couple protected with an outer sheath by leaving the couple in the metal while it cools down to the freezing point, readings being taken every half minute or minute. In such a procedure the readings gradually decrease as the temperature of the metal drops until the freezing point is reached and then the temperature remains practically constant until all the metal, or at least that in the immediate vicinity of the couple, is frozen. The time temperature curve for a quick reading couple in molten aluminum will show a sharp change in direction when the freezing point is reached, but the same curve for a couple in a protection tube may show a less abrupt change in direction due to the lag in temperature change introduced by the heavy walled protection tube.

Given the temperature at which the metal freezes and the reading of the pyrometer when freezing is taking place, as shown by the reading of the pyrometer remaining constant or practically so over an appreciable length of time, the correction to the pyrometer is the difference between the two. For example, if the freezing temperature of the metal is 1160 degrees Fahr. and the pyrometer reads 1155 degrees Fahr., then the correction to the pyrometer reading would be + 5 degrees Fahr. If the couple is not left in the metal until it has frozen solid it can be withdrawn easily and the mushy metal in the crucible or ladle dumped out before it has set. The metal on the thermocouple can be melted off in a ladle of hot metal.

Most alloys of aluminum cannot be employed satisfactorily for the calibration of pyrometers by the freezing point method because the thermal arrests are not large enough or sharply enough defined to clearly register on the usual shop pyrometer. However, there are some alloys which experience has shown to be suitable for calibration of plant pyrometers by the freezing point method and two of these are given in Table I.

A ladle of miscellaneous scrap or secondary metal should not be used for this purpose unless its freezing characteristics have been determined carefully by previous tests with standard pyrometric equipment of known accuracy.

Every pyrometer installation should be checked and calibrated periodically

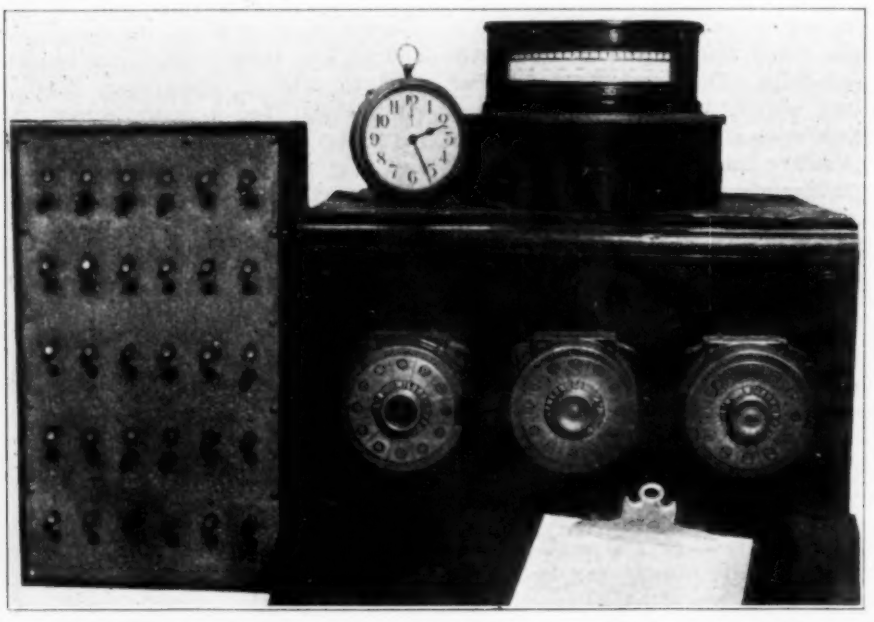


FIG. 3—MELTING FURNACE PYROMETER AND SIGNAL SWITCH BOARD.

FIG. 4—CENTRAL PYROMETER STATION AND SIGNAL BOARDS

to make sure that it is reading correctly, for there is not a pyrometer on the market nor can one be made that is absolutely infallible. The temperature E. M. F. characteristics of the thermocouples may change after being in use, loose connections not visible to a casual observation or even inspection may develop, the zero setting of the galvanometer may shift or be changed either accidentally or maliciously—in fact, there are many things which may occur to cause a pyrometer to read incorrectly.

In an aluminum foundry it is a simple matter to calibrate a pyrometer by the freezing point method, and although the instrument will be used at a temperature 200 or 300 degrees Fahr. higher than the temperature at which it can be readily calibrated by the above method, it is fairly safe to assume that if it reads correctly at the freezing point of one of the aluminum alloys it also will read correctly at a temperature 250 degrees Fahr. higher. However, if there is an appreciable error, say 10 to 20 degrees Fahr., at the freezing point of aluminum, the error at a temperature of 250 degrees higher may be greater or less, depending on the type of couple and the cause of the discrepancy.

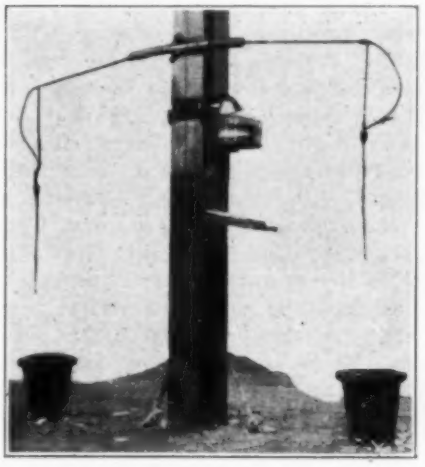


FIG. 5—POURING STATION IN FLOOR CASTING ROOM

Aluminum Alloys Suitable for Calibration of Plant Pyrometers

Composition by Per Cent						Total impurities	Alloy No.	Approximate freezing point
Cu	Si	Zn	Fe	Mg	Mn			
7.0-8.5	.....	0.2m	.....	....	.....	1.7	12	1,160° F.
0.15m	12.0-13.0	0.2m	0.8m	T	0.7m	.....	47	1,071° F.

m = maximum.

Recording Pyrometers Valuable

For melting pots or furnaces an indicating pyrometer serves, but by adding a recording pyrometer, a reliable record of the exact operation of the furnaces can be obtained, which in some cases is desirable.

For core ovens, either indicating or recording thermoelectric pyrometers or industrial thermometers, indicating or recording, may be used. With core ovens where the rate of baking affects the quality of the cores there is more need of recording instruments than with melting furnaces. A single record recording thermometer costs less than a single record thermoelectric pyrometer and properly installed should be just as satisfactory, but if several temperatures are to be recorded, a multiple record pyrometer may be cheaper, and therefore, the question of which type of instrument to use depends largely on the cost of the complete installation.

Automatic temperature controllers on core ovens should provide for the most uniform baking that can be obtained and should be well worth while in many instances.

In the melting room of one of our foundries there are 24 tilting pot furnaces of 400 pounds capacity and 9 stationary furnaces of 300 or 400 pounds capacity used for melting aluminum for sand castings.

Each tilting furnace is equipped with one thermocouple suspended by a counterweighted cable or chain. When not in actual use it hangs above the furnace. The couple consists of No. 8 Brown & Sharpe gage chromel-alumel elements, asbestos insulated, and is connected to an indicating pyrometer by auxiliary lead wire and selector switch. The couple is protected by a cast iron sheath, supported by a holder attached to the cable. The couple simply rests in the sheath with the hot junction at the bottom.

The indicating pyrometer, selector switches and signal board switches are located inside a brick enclosure, while the signal boards are outside, above the pyrometer booth. The signal boards consist of a series of numbers on glass, corresponding to the furnace numbers, with lamps behind each number. On the signal switch board in the booth there is a switch for the lamp behind each number, by which the pyrometer man can illuminate each number as desired. There is also a whistle cord in the pyrometer booth by which a whistle can be blown as an auxiliary signal.

Description of Station

Fig. 2 shows a dimensioned drawing of a cast iron pyrometer tube and the holder for the tube. The supporting cable or chain is attached to the holder by two machine screws inserted in the drilled and tapped holes in the end of the holder. The tube is securely held but can be removed easily whenever necessary.

Fig. 4 shows the exterior of the station, a small portion of the interior and one of the signal boards. The numbers were all illuminated simply to make them visible in the photograph.

Fig. 3 shows the three selector switches mounted on the vertical panel at the back of the desk and the indicating pyrometer above. In this picture the glass dome which protects the instrument from dust and fumes was removed while the picture was being taken. To the left of the selector switches can be seen the signal board switches by which the numerals on the signal boards are illuminated.

As soon as the complete charge in the cast iron pot has been melted down, the thermocouple and sheath are lowered into the molten metal, by the furnace tender, to a depth of immersion of about 12 inches. The pyrometer man observes the temperature of the metal in each pot every few minutes and as each charge reaches the proper temperature, he illuminates the corresponding number for that furnace on the signal board. The furnace operator then adjusts the burner on that pot to hold the temperature constant, extinguishing the burner and relighting it later, if necessary, until the metal is poured.

If, by any chance, the furnace operator fails to observe the signal or observing it, fails to act accordingly,

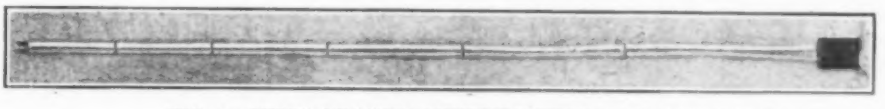


FIG. 6—QUICK READING THERMOCOUPLE AND CONNECTOR

the pyrometer man blows one blast on the whistle, which reminds him to observe the signal lights for his bank of furnaces. Just before a furnace is emptied, the time and the temperature of the metal are taken and recorded by the central station pyrometer man and the couple is then pulled up out of the way.

At the end of the day, the cast iron thermocouple sheaths are cleaned carefully to remove any clinging aluminum or loose protective coating and then recoated. The suspension cable is long enough to enable the operator to lower the sheath to a position where it can be handled easily for cleaning and coating without actually removing it from the holder. The protective coating is put on with a whitewash brush while the sheath is still warm, but below the boiling point of water; it consists of whiting (French chalk or calcium carbonate) mixed with enough water to give a rather thick, although still quite fluid, wash. Whiting is used in making up the wash in place of the lime (calcium hydrate) previously mentioned, because it is believed there is a tendency for the whiting wash to adhere to the tube more satisfactorily. It might also be mentioned that each cast iron pot is scraped out and recoated with the same wash each day in practically the same manner as the sheaths.

Protective Coating

Properly coated each day, these cast iron sheaths last from 6 to 8 months; the ultimate failure usually is caused by oxidation of the iron. The protective layer of whiting prevents the aluminium from coming in contact with the cast iron and therefore prevents any alloying or solvent action on the tube.

Tests made by the writer of many different heat-resisting alloys have failed to disclose a single one which would resist satisfactorily the alloying action of molten aluminum and since a cast iron tube coated with lime or whiting can be used each day for 6 or 8 months, they are more economical than an alloy tube, which also would have to be coated in the same manner if it were to last for a reasonable length of time.

The metal in the tilting pot furnaces is poured into 100 pound pouring crucibles which then are taken into the floor casting room on buggies. Before a crucible of metal can be taken to a mold it must be checked at the pouring sation by an inspector. At each pouring station in the floor casting room there are two quick reading thermocouples connected to an indicating pyrometer by auxiliary lead wires and a two-point selector switch.

Fig. 5 shows the indicating pyrometer and selector switch mounted on the building column and the two quick reading thermocouples suspended from chains attached to a short length of ½-inch conduit anchored in a close-wound spiral steel spring. The spring provides flexibility and enables the operator to pull the couple down into the metal. While the temperatures are being taken, the crucible of metal stands on the pedestals beneath the couples. To show the essential features of this photograph, the background was blocked off.

Fig. 6 shows a new couple all ready to be connected to the lead wires. The steel bands, made of short length of seamless steel tubing, which hold the

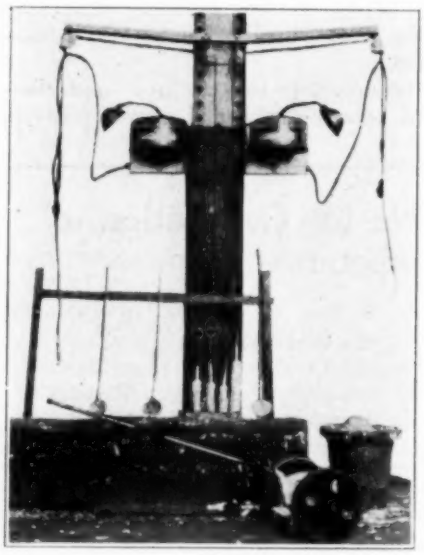


FIG. 7—BENCH POURING STATION

two elements of the couple together, can be distinguished in the picture.

If the inspector finds that the temperature of the metal is too high for the particular mold for which it is intended, it is allowed to cool naturally or by the addition of clean solid pieces of the same alloy. No light or dirty scrap is used for cooling a ladle of metal, because such material is a source of much trouble in causing the formation of inclusions and porosity in the castings.

For each ladle of metal passing through the pouring station, the inspector records the temperature of the metal as received from the furnace, the furnace number, the time it was received, the time and temperature at which it was sent to the mold, and the number of the job on which the metal is to be used.

From the pouring station and central pyrometer station records, the history of all the metal used for any job can be traced back from the mold to the composition sheet in the melting room, and it can be ascertained readily whether a defective casting was caused by improper temperature conditions.

As shown in Fig. 6, the pyrometer at the pouring station consists of an indicator connected to two quick reading couples of No. 8 Brown & Sharpe gage chromel-alumel wire, asbestos insulated and made up with an open hot junction as previously described. Every three days, the hot junction ends are cut back about 3 inches to keep the couple in good condition, for although the asbestos insulation wears off at about the same rate as the wires are consumed, it may become frayed further back and constitute a potential source of trouble.

There are three pouring stations serving a casting floor about 100 x 240 feet. The pyrometers at these stations are calibrated each morning by the freezing point method. Auxiliary cold junction couples buried to a depth of about 15 feet maintain a constant cold junction temerature.

Bench Molding Procedure

For the major portion of the bench work a slightly different procedure is followed. The pouring crew take the metal directly from the stationary furnaces with hand ladles in which it is carried to the pouring station in small buggies where the temperature of the metal is taken with a quick reading thermocouple. If the metal is too hot, it is allowed to cool naturally or by the immersion of iron chills which are well limed.

Fig. 7 shows two indicating pyrometers and the quick reading couples connected to them. The iron chills and skimming ladles can be seen below the indicators and in the foreground is one of the small buggies and a ladle of metal. At this station, the quick reading couples are suspended by counterweighted chains. The pouring ladles for the bench work are small and the heat losses between the pouring station and some parts of the bench room are appreciable so that allowance is made for the drop in temperature between the pouring station and the bench.

The core ovens in this foundry are oil fired and each one is equipped with a thermocouple connected to an indicating pyrometer by auxiliary lead wire and a selector switch. With the aid of this pyrometer the ovens can be operated according to any predetermined schedule and baking conditions can be duplicated from day to day.

In the heat treating department

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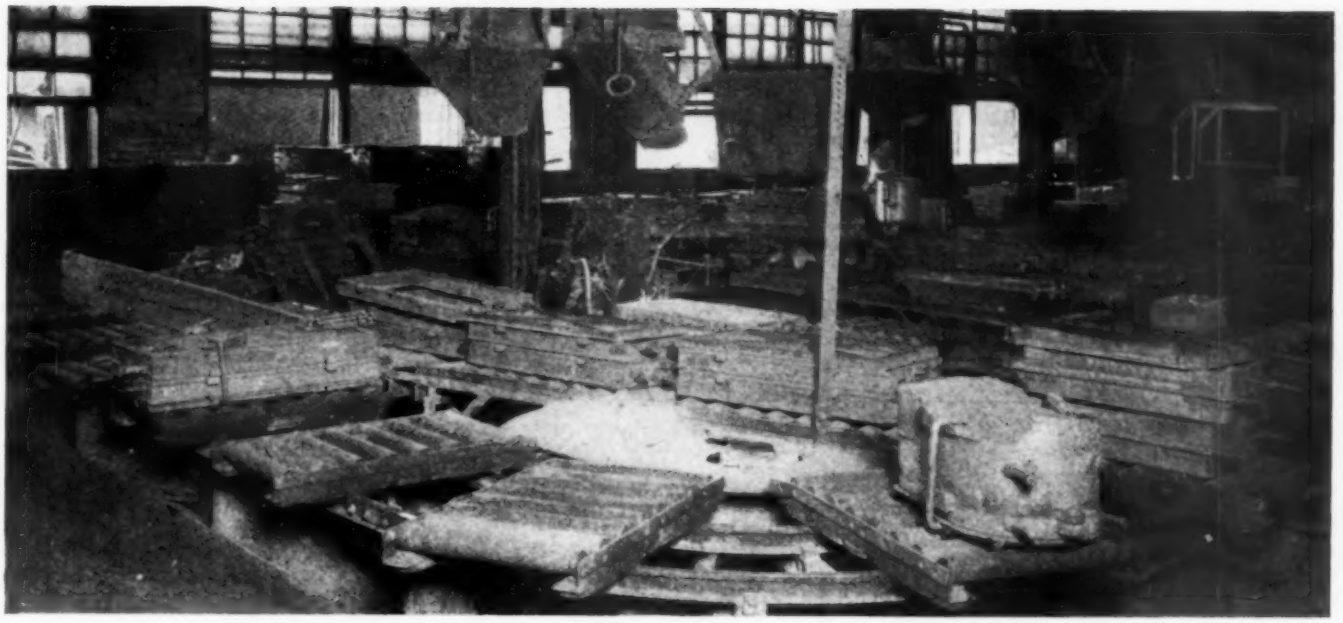


Fig. 1—The Large Conveyor Handles Molds on Iron Shod Roller Trays

Mold and Sand Handling System Attains Economies

By R. J. Heiserman
(*Link-Belt Co., Chicago*)

AFTER more than a year in continuous operation the American Radiator Co. has had the opportunity to prove the worth of its new sand and mold handling system at the Bond plant, Buffalo.

This system, consisting of one sand handling and two power mold conveyors, installed by Link-Belt Co., Chicago, has operated this length of time without any changes in the original layout and a higher production has been attained than originally was figured.

The following table illustrates the comparison between the old floor method and the mechanical operation whereby the lifting, carrying out, shoveling and back breaking labor practically has been eliminated:

Production of molds per man hour

OLD METHOD		
Small Machine Molding Unit	Snap Flask Unit	Maintenance Cost per 1000 lbs.
5.75	18.25	$1.80
WITH MECHANICAL CONVEYORS		
Small Machine Molding Unit	Snap Flask Unit	Maintenance Cost per 1000 lbs.
9.70	30.55	$1.47

In addition a 50 per cent saving in floor space is reported, while mechanical methods require only 25 per cent of flask equipment formerly used. Possibility is offered for running two, or even three shifts a day in which case maintenance and investment costs are greatly reduced. Night labor of shakeout sand preparing men is eliminated and storage of rough castings avoided as they proceed in a continuous flow to and through cleaning and machining departments.

System Is Complete

The system, as mentioned, consists of one sand-handling unit and two power mold conveyors. The latter are shown in Fig. 2. The large mold conveyor is operated in a horizontal plane, and travels in a rectangular path 68 feet center line in the long direction and 21 feet across. A portion of this conveyor is shown in Fig. 1. The trays are made of sections of gravity roll 21 x 40 inches on the bottom of which are attached hard white iron wearing shoes which travel and slide on T-rail tracks.

The trays are propelled by a single strand of chain, suspended from the bottom of trays by special long joint pins with cotters. In this way, while the chain is propelling the trays, the trays are supporting the chains. This avoids the use of tracks, guides or rollers for the train. The trays are spaced every 42 inches and travel at a speed of 14 feet per minute which gives a resulting capacity of 200 molds per hour if all trays are filled.

The conveyor is driven at one corner by a 10-horsepower motor with a belt drive to a reducer, and thence to a vertical shaft through a set of cast-steel bevel gears. The take-up shaft is located adjacent to the drive shaft while at the far end of the conveyor are the two plain turn shafts.

All sprockets for the chain are cast iron, 81-inch pitch diameter, with a circular T-rail track attached to the top to carry the inside end of trays in going around the corners.

The molds carried on this conveyor measure 16 x 34½ inches and are 7 inches deep. The molds are made in cast-iron and steel flasks on six roll-over and six stripper-type molding machines provided by the Milwaukee Foundry Equipment Co., Milwaukee. These are operated by 16 men, including the coresetters and the men who close the flasks.

Two short sections of gravity conveyor run on each side of a set of molding machines, on one of which the molds are cored, closed and delivered to the power conveyor while the other returns the empty flasks to the molding machines from the power conveyor.

After the mold is clamped, it is

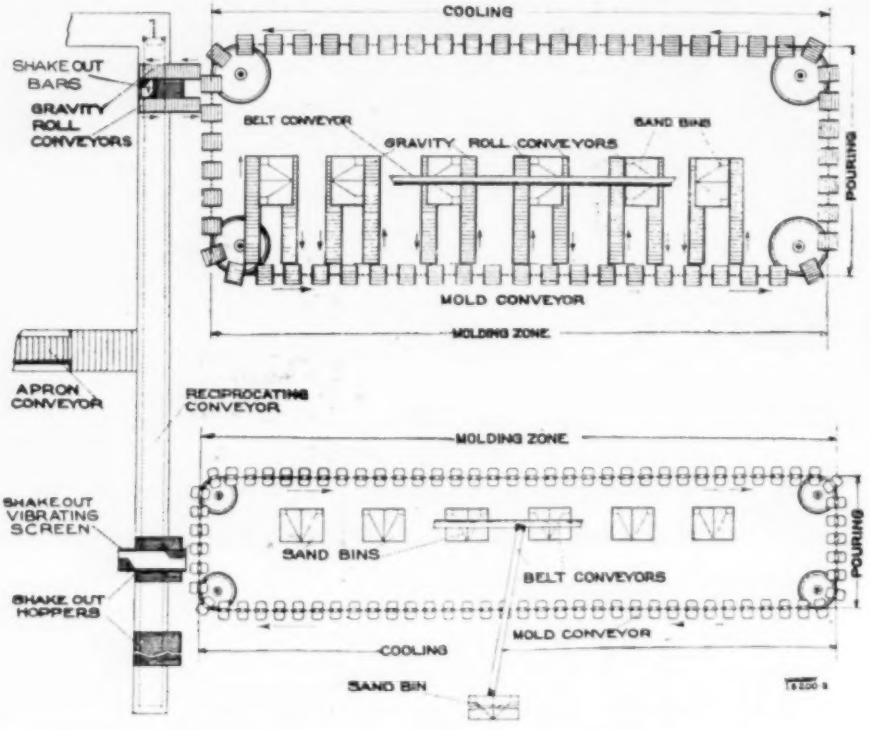


Fig. 2—Two Complete Units Designed to Handle Different Size Molds Deliver Castings in Their Molds to the Shakeout at the Left

pushed from the stationary gravity conveyor to the gravity roll trays on the pouring conveyor. This arrangement makes it unnecessary to lift the mold in transferring it to the power conveyor, and as the transfer is made with the power conveyor in motion, no time is lost.

The molds, having been placed on the power conveyor, are conveyed toward the pouring end and two men pour them as the molds pass across the 21-foot end. During the travel from the pouring zone to the shakeout end, the molds are cooled, and just after they have turned the driving sprocket, they are pushed off manually on a short section of gravity conveyor at one side of the shakeout grating. Here two men break open the molds and as they shake out the two halves the flasks are placed on a second section of gravity conveyor by which they are returned to the power conveyor by a man at this point.

The castings are hooked out by a worker, when the cope has been removed and other workers remove castings to castings conveyor and to the cleaning department.

Each empty flask and bottom board next is carried back on the power conveyor to the molding station. As these pass the molder who is using that particular flask they are pushed off of the power conveyor to the flask storage gravity conveyor alongside of each pair of molders. One man traveling along the side of the power conveyor takes care of this operation.

Handling Larger Molds

On the side of the foundry opposite to the conveyor described is the power mold conveyor for handling the molds that are 12 x 16 inches long and from 5 to 8 inches deep, both of snap and steel flask variety. This conveyor, as shown in Fig. 3, is similar in construction to the other, with a few exceptions.

The path of travel of this size mold is 72 x 11 feet, 6 inches, the trays being hard white iron castings sliding directly on the T-rail

Fig. 3—The Molding Conveyors Shown in the Lower Portion of Fig. 2 Take the Smaller Molds, Carried on Flat Trays

tracks as illustrated in Fig. 4. These tracks are greased once a day and judging from the wear resulting from the first year of service they should last at least four years. The trays are spaced 27 inches apart and travel at a speed of 20 feet per minute. The corner sprockets are 57 inches pitch diameter and a 7½-horsepower motor furnishes the power.

Twelve molders working on 12 squeeze type molding machines place the completed molds directly on the power conveyor. Just before the molds turn the corner into the pouring zone, a man stationed at this point places a weight on top of each. Two men do the pouring as the molds pass across the shorter side of conveyor, and they accomplish this work at the high speed the conveyor travels, without the aid of a moving pouring platform. The ladles used hold about 250 pounds of iron and are suspended from an overhead track with a chain block. About 5 seconds are required to pour each mold.

After the molds have turned the next sprocket, or corner, and have started along the cooling side of the conveyor, weights are lifted off manually and placed on a section of gravity conveyor which returns them to the weight placer on the opposite side of the power conveyor. The molds having traveled the full length of conveyor, are cooled and one man picks them up at the shakeout and dumps them into a vibrating shakeout screen, where the sand and castings are separated. The sand drops through to the shakeout grating, while the castings are discharged over the end into a wheelbarrow. Flasks,

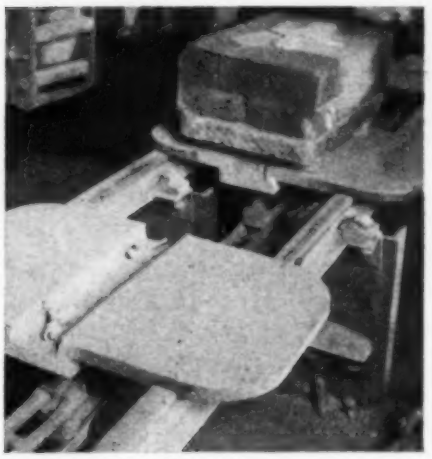


Fig. 4—Hard Iron Trays Propelled by Chain Carry the Smaller Molds as Shown in Fig. 3

bottom boards and bands again are placed on the power conveyor trays and in this way are returned to the molder, who picks off the ones he wants as they come to his station.

A gravity conveyor molding unit is placed between the small mold conveyor and the wall. This consists of a rollover and stripper type machine and two lines of gravity roll conveyors. The molds are cored, closed, poured, cooled and conveyed to the shakeout hopper on one line of the gravity conveyor. The second line of gravity conveyor is used for returning the empty flasks to the molding machines and for storage of flasks. This unit is for large heavy work of a miscellaneous character that cannot be made on either one of the two-power molding units.

Sand drops through the gratings at the three shakeout hoppers and then is fed uniformly by feeders on the bottom of these hoppers to a reciprocating conveyor that is 36 inches wide and 87 feet long. A 15-horsepower motor drives this machine. The reciprocating conveyor gives the sand a preliminary mixing and at the same time conveys it to the foot of elevator.

The elevator has a 37-foot center line, and is made up of a 16-inch belt with 7 x 14-inch malleable iron buckets spaced every 24 inches. A 5-horsepower motor drives this elevator. From the elevator the sand passes upon a 4 x 5-foot vibrating screen, the screen cloth being No. 8 wire with ⅝-inch mesh. This screen is driven by a 5-horsepower motor.

Directly beneath the vibrating screen is a collecting hopper with a capacity of about 5 to 7 tons of sand. This hopper is used to give a uniform feed of sand to the tempering belt. A gate is provided at the bottom of the tempering belt hopper so that the capacity may be regulated on the belt, and as the sand passes along it is raked, tempered and raked again before it is discharged into the revivifier.

A magnetic separating belt has been installed over the tempering belt for drawing out small shot and particles of iron that have not been caught by the vibrating screen. The tempering belt conveyor is 24 inches wide and has 21-foot centers. It moves at a speed of 100 feet per minute. The next machine in cycle of operation is the revivifier which is driven by a 15-horsepower motor which also drives the tempering belt.

The sand discharged from the bottom of the revivifier is collected on

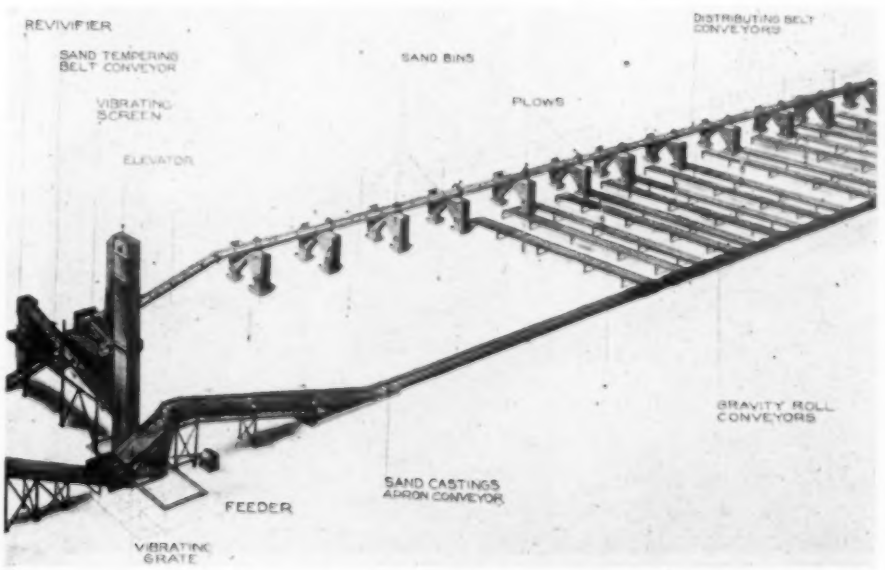


Fig. 5—Detail of the Complete Sand Handling Unit with the Tempering and Screening Equipment at the Left

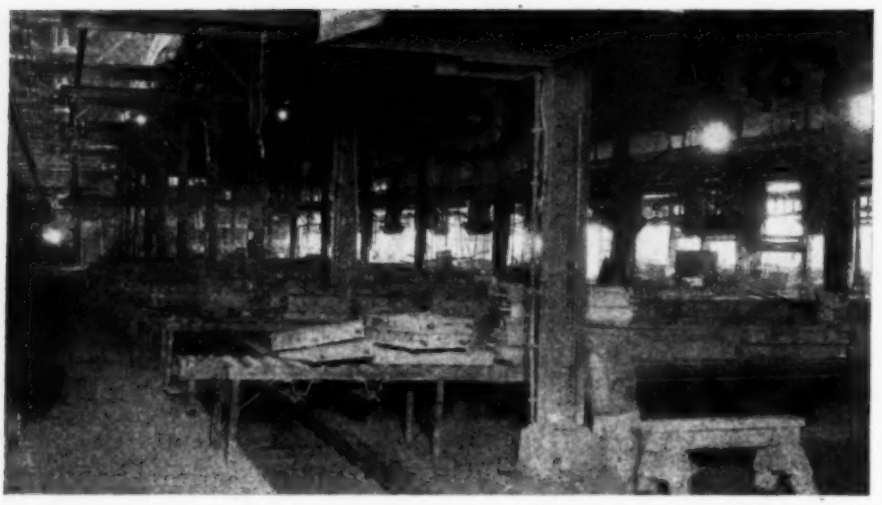


Fig. 6—Roller Runout Conveyors Terminate Directly Over the Sand and Castings Apron Conveyor

the foot end of the first distributing belt conveyor, 24 inches wide with 91-foot centers and is conveyed to plows which plow it off into the molding sand hoppers over the molding machines.

One man tempers the sand at the tempering belt and a second operates the plows on the first distributing belt feeding to the molding sand hoppers. When these hoppers all are filled all the plows are raised and the sand is discharged over the end upon the cross belt conveyor, 24 inches wide with 48-foot centers, which discharges upon the second distributing belt.

The second distributing belt also has a man in attendance for operating the plows, and when all of the bins are filled, sand passes over the discharge end and either is discharged back into the reciprocating conveyor or is used on some of the hand floors which are nearby. The second distributing belt is 24 inches wide and is 73 feet between centers.

Sand for the small gravity roll unit against the wall also is provided from the second distributing belt by a 24-inch belt conveyor.

The two distributing and one cross belt conveyor each are equipped with a 5-horsepower motor. The short conveyor to the auxiliary molding unit is equipped with a 3-horsepower motor.

Although there is little sand storage in this system, no difficulty has been experienced due to hot sand, and a fine finish is obtained on the castings without the use of facing. All of the molding sand hoppers over the molding machines are equipped with duplex gates, and are so located that the sand drops directly into the molds.

Although the sand handling system was designed for handling 60 tons per hour, it often is called upon to handle as much as 70 tons.

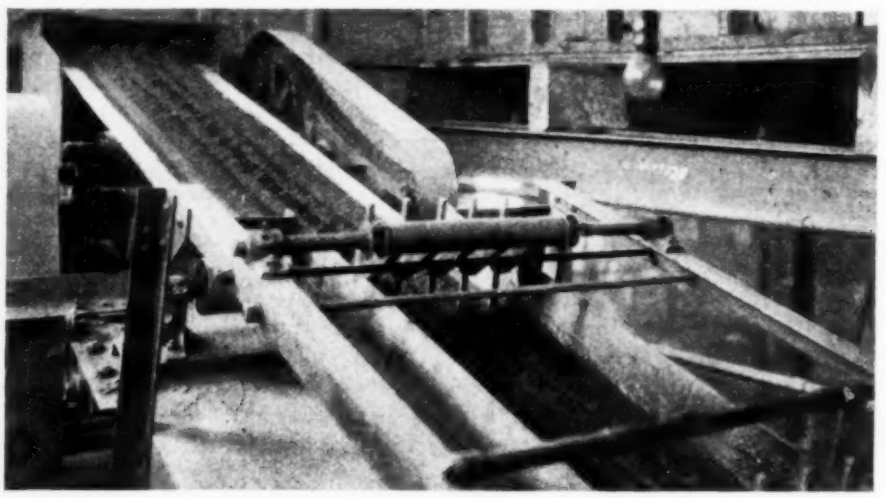


Fig. 8—Detail of the Tempering Belt Shown at the Extreme Left of Fig 5

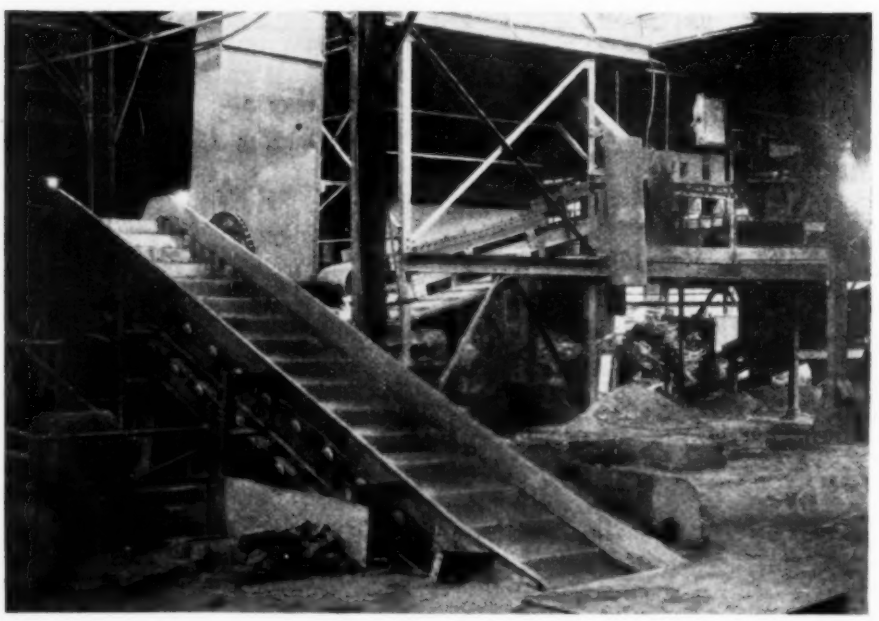


Fig. 7—The Sand and Castings Conveyor Delivers at the End of the System and the Sand Enters the Treating Machinery

This sand handling and preparing system is made up of the following machines; built by the Link-Belt Co.

Shakeout hoppers.
Reciprocating conveyor.
Centrifugal discharge elevator.
Vibrating screen.
Collecting hopper under vibrating screen.
Tempering belt conveyor.
Magnetic separator.
Revivifier.
First distributing belt conveyor.
Hoppers over Davenport machines.
Cross belt conveyor.
Second distributing belt conveyor.
Hoppers over snap flask molding machines.
Auxiliary distributing conveyors.
Auxiliary mold hoppers.

J. C. Reich is manager of the Bond Plant.

Sillimanite bonded with 15 to 20 per cent fireclay and fired has been suggested for making semi-permanent molds for iron, steel and other metals.

PLAN
Program for Visitors

TENTATIVE plans for the entertainment of visitors at the convention of American Foundrymen's association in June are being prepared by the leaders of various foundry organizations in Chicago and vicinity. General entertainment features will be handled by a committee organized by the Chicago Association of Commerce, the organization which extended the official invitation to the American Foundrymen's association to hold the convention in Chicago.

The association of commerce recently asked the heads of various foundry organizations and many leading foundrymen of the metropolitan area to meet and organize a committee which will provide for entertaining the visiting foundrymen and wives during the convention week, June 6 to 9.

A committee of the Chicago Foundrymen's club already is at work mapping out a comprehensive plant visitation program. The members of the club have assumed responsibility as hosts to the visiting delegates for group tours of inspection to foundries in the Chicago area as well as for providing facilities for visits by smaller parties or individuals.

Among the plants for which consent already has been obtained for visits are the Deering works of the International Harvester Co.; the Chicago Hardware Foundry Co., the Illinois Malleable Iron Co., the Hubbard Steel Foundry Co., East Chicago, Ind., and the Whiting Corp., Harvey, Ill.

Albert N. Wallin, of S. Obermayer Co., secretary of the Chicago club, is conferring with the managements of about 50 plants in the Chicago district to obtain consent for contemplated visits of guests during convention week. The names of the foundries were selected by the committee of the Chicago club. A list of the foundries and other plants available for visitation will be furnished to visitors at convention headquarters. A booth will be maintained at the Edgewater Beach hotel, at which will be members of the committee of the Chicago Foundrymen's club to direct those who plan to make visits and to supply information concerning the plants listed in the booklet for visitation. When group tours of inspection are to be made, busses will be furnished.

Plan Regular Routes

The committee of the Chicago club has been subdivided into three groups of three each, one to have charge of plant visitation on the north side and northwestern suburbs of Chicago, another for the west side and western suburban territory and the third for the south side and points just south, southeast and southwest of Chicago. The three who are serving on the north side subdivision of the committee are J. H. Hopp, Hopp-Patterson Co.; G. Olsen, Illinois Malleable Iron Co., and Rogers A. Fiske, of the *Iron Age*. Those who are in charge of west side plant visitation are John Marr, Nugent Steel Casting Co., R. T. Martin, International Harvester Co., McCormick works, and A. V. Magnuson. The south side plant visitation committee members are R. W. Freeland, Hubbard Steel Foundry Co., G. P. Fisher, Whiting Corp., and E. W. Smith, Crane Co. H. S. Vrooman, of the H. S. Vrooman Co., is chairman of the committee. Other members are George H. Rolinson, American Brake Shoe & Foundry Co., president of the Chicago Foundrymen's club, and the secretary, A. N. Wallin. Each member of the committee is empowered to appoint subcommittees. These are being named.

A special feature of the week's entertainment will be a boat ride along the shore of Lake Michigan Thursday afternoon, June 9. A special luncheon is being planned for Thursday noon at the large municipal pier, which may be reached from any point in the loop in 15 minutes by taxi. After the luncheon, the foundrymen and ladies will board the boat for the beautiful lake trip . The foundrymen will have an opportunity of seeing the famous north shore, the beautiful skyscrapers along the lake front loop and the center of the iron and steel industry along the south.

On Monday the ladies will register in the Edgewater Beach hotel and will have the remainder of the day for shopping. On Tuesday morning at 10 they will be taken for a ride through the section north of the hotel and will see Evanston and Northwestern university. The party will return to the hotel for luncheon and in the afternoon a theater party is being planned at one of the uptown theaters. On Wednesday morning at ten the visiting ladies will be taken for an auto ride along the south shore and will visit the Field museum, the Midway and Chicago university, Jackson park and other points of interest in that section.

The party will return to the loop at noon and will have luncheon at Marchall Field & Co. After luncheon the ladies will attend a special style show and then will be taken for an inspection trip through the large stores. On Wednesday evening the ladies will attend the annual banquet.

Thursday morning will be left open for shopping. The ladies will go to the Municipal pier immediately after luncheon for the boat ride.

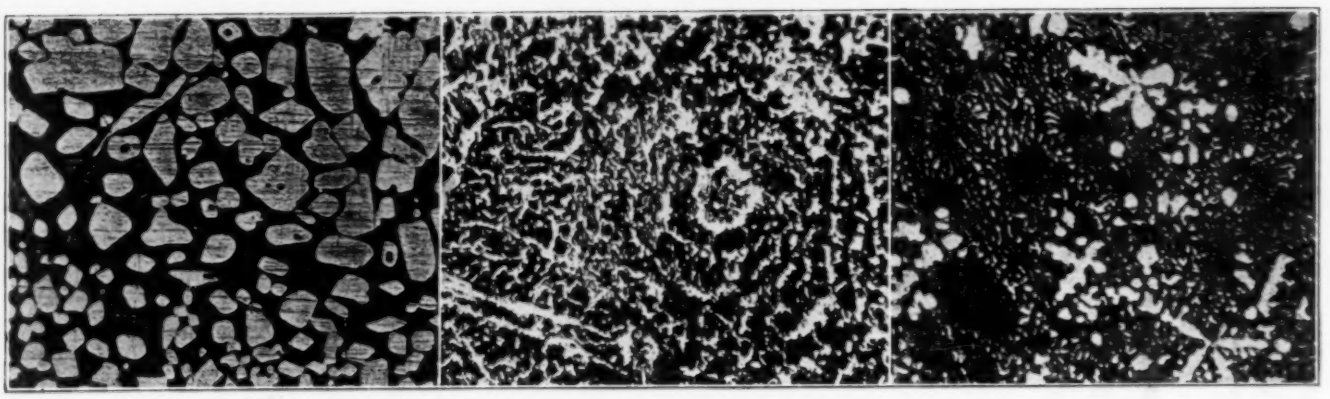


Fig. 1—Cubic Crystals in Hard Spelter, X 50. Fig. 2—Onion Type of Freezing in Zinc Base Alloy, X 50. Fig. 3—Star Crystals in Zinc Base Alloy, X 150

Microscope Is Useful Adjunct in Nonferrous Investigations

By J. S. Glen Primrose

SINCE the author drew attention to the importance of metallography as an aid to the iron-founder at the British Foundrymen's association's Glasgow convention in 1911, there has been an increasing use of the microscope as an adjunct to foundry work. The wide scope of its application to control and investigation work in the nonferrous field has been dealt with by noted writers in the Institute's proceedings.

There are so many aspects of the case—whether pure research into new properties, pathological investigation of failures, or examination to insure compliance with rigid specifications—that it is not possible in limited space to deal fully with all of these. The present object is to draw attention to the results of some slight practical experience in all of these fields, which may prove of value to practical workers endeavoring to establish standards of comparison to follow or avoid.

The general tendency lies in the direction of illustrating only ideal structures and those representing exceptional conditions or strengths. It is often more valuable to be able to recognize the appearance of defective structures to assign the proper cause to them, and thus know the direction to go to avoid a repetition of the trouble. Another common failing is to resort too soon and too frequently to excessively high powers of magnification for the particular structure under examination, and thus the general appearance of the structure may be overlooked. Wherever possible, a three-fold record should be taken showing first the simply polished surface to indicate size and distributions of inclusion or blowholes at low powers, then the same spot suitably etched, and finally a definite central area at a higher magnification to reveal the minute arrangement not seen at low power.

When using arc-lamp illumination, the great tendency is to overexpose the photographic plate, even when such slow speeds as *H* and *D* 45, if the fine-grained ordinary variety is used. A screen is employed partly to counteract this, and to sharpen the image by elimination of the various light wave lengths which are not registered correctly by achromatic objectives and huyghenian eyepieces. One of the most generally useful is the *K* 10 yellow screen, which may be se-

FIG. 4—SPINE CRYSTALS IN ZINC BASE ALLOY, X 150. FIG. 5—HOLO-CRYSTALLINE STRUCTURE OF FORGED *A* METAL, X 50. FIG. 6—DUPLEX STRUCTURE OF CAST B METAL, X 50

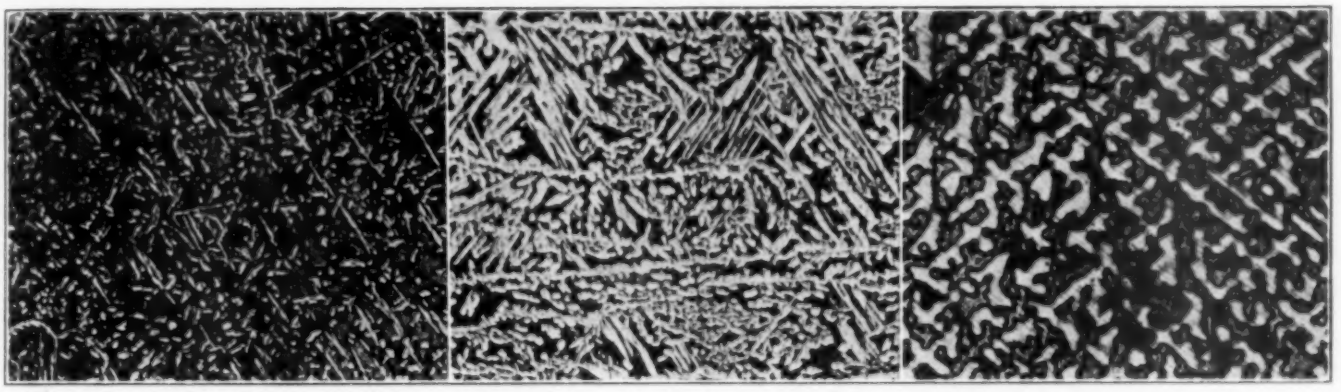


FIG. 7—DUPLEX STRUCTURE OF CAST C METAL, X 50. FIG. 8—ELONGATED STRUCTURE OF FORGED G METAL, X 50. FIG. 9—INTERLOCKING STRUCTURE OF GOOD PHOSPHOR BRONZE, X 50

cured either in glass or as a gelatine film, but for other purposes the green filter is used frequently.

The disadvantage of liquid filters is that they are difficult to keep clear of bubbles, and even the cooling trough presents the same feature unless potassium-alum is dissolved in it to form a concentrated solution. Special light filters are required when panchromatic plates are used, and also in the case of recording the various shades of color produced on polished specimens by suitable heat-tinting or oxidation etching, by the aid of the autochromatic plates.

When particularly high resolving power is required from a microscope lens system, it is found that this advances in direct proportion to any decrease in the wave length of the light used. Thus for high powers, when research is being undertaken into the inner structures of eutectics, or of microscopical constituents the exact shape of which is not revealed by ordinary white light, it is possible to make use of ultra violet light.

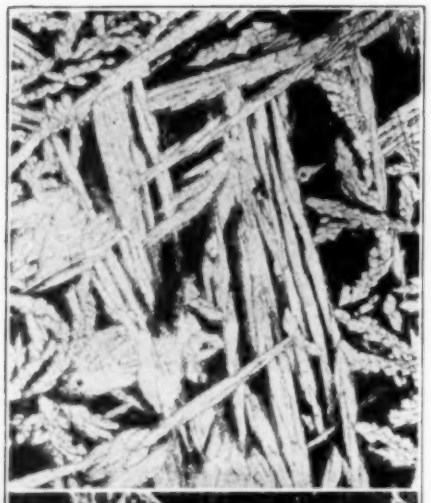
By utilizing the special objectives known as *monochromats*, designed from the formula of Dr. M. von Rohr, which are corrected for ultra violet light having a wave length of 275 microns, the resolving power is double that of a similar numerical aperature ordinary lens. These lenses are made of quartz which has not been fused, as this destroys their refractive index, but simply rendered plastic by heating in an oxyhydrogen flame, and then molded to the approximate shape required. Polishing to the correct shape requires special care, and they can be used only with this light, being useless for light of different wave length, particularly daylight. The 6 millimeter objective is used dry, but the two higher powers avaliable for magnifications between 3000 and 5000 diameters, and having numerical aperatures of 0.85 and 1.25 respectively, are immersion systems, in which the fluid used is a mixture of pure glycerine and distilled water in the proportions calculated to give a definite refractive index.

Eyepieces, for projecting the image on the photographic plate, are made also of quartz, and similarly the necessary condensers in the illuminating apparatus are made of the same material. So are the two right angle prisms used on the optical bench for reflecting the light emitted by a nearly continuous series of sparks, produced by the leyden jar and large induction coil, between the points of the cadmium electrodes. The photographic apparatus recommended for use with this outfit is the vertical form of camera attached to a steel upright which can be swung about its bottom pivot. This alternately will bring into position over the microscope eyepiece, the searcher, consisting of a fluorescent screen of uranium glass which renders the otherwise invisible image capable of being focused by a powerful magnifier and then the camera which, if approximately extended 30 centimeters permits the exposure to be made with-

Presents Notes

OBTAINING micrographs of nonferrous metals and alloys as an aid to further investigation in determining causes of failure or as a control in meeting rigid specifications, is becoming almost as essential as other routine tests of chemical and physical characteristics. The author points out some rules to be observed and admonishes the investigator to examine specimens under low power of magnification before etching so that the general structure may be seen, before resorting to high magnification of special constituents. This article is abstracted from a paper presented at the London meeting of the Institute of British Foundrymen, 1926.

FIG. 10—NODULAR STRUCTURE OF PHOSPHOR BRONZE CAST COLD, X 50. FIG. 11—RECTANGULAR STRUCTURE OF PHOSPHOR BRONZE CAST TOO HOT, X 50. FIG. 12—EUTECTIC STRUCTURE OF PHOSPHOR BRONZE *SWEAT*, X 100

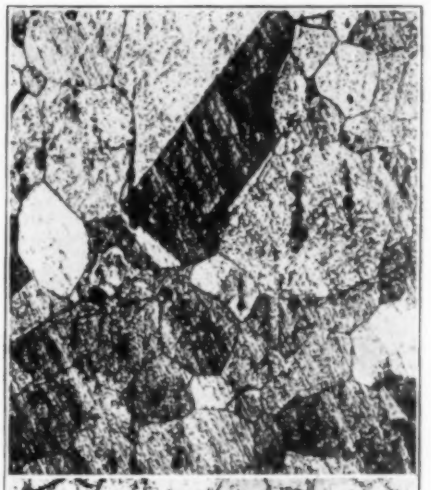


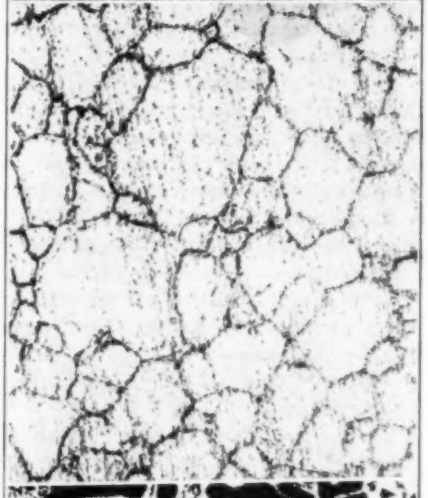
On the left from top to bottom, Fig. 13—Alpha beta structure of aluminum bronze, X 50. Fig. 14—Eutectoid separation in self annealed aluminum bronze, X 200. Fig. 15—Nodules and eutectic of cuprous oxide in copper, X 100. Fig. 16—Intergranular separation causing brittleness in gassed copper, X 200

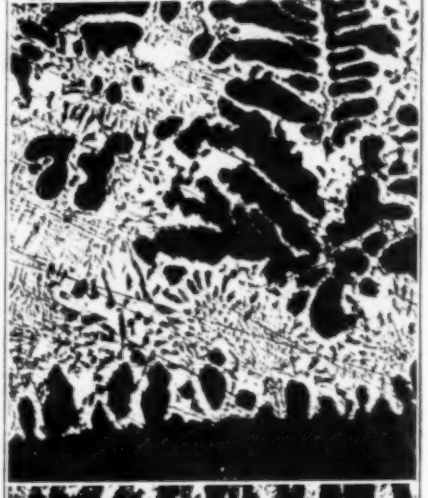
out further changes and inspection.

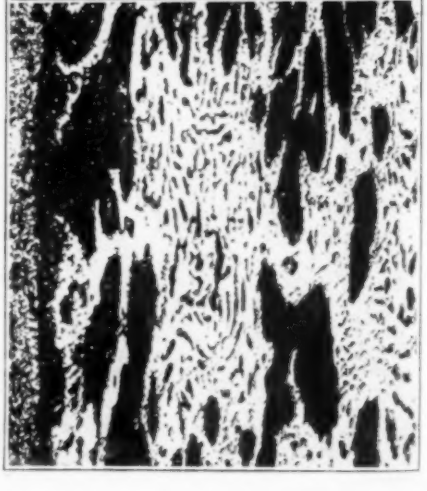
In the scope of nonferrous metallography there is a great variety of known types of structure and an even richer vista opens before the practical worker in this field than in the general run of the ferrous metal structures. To the research student there is an even greater possibility of variations and the careful development of these by suitable polishing means and selective etching reagents is an interesting and instructive range of work. Numerous lists have appeared from time to time of special agents of limited application, but it is surprising what useful applications can be made of the old ferric chloride solution in the majority of practical working cases.

Quite remarkable types of structures can be revelaled in a series of zinc base alloys by proper etching. The simplest is the well known cubic or rhombohedric formation when a definite compound is formed and has but little solubility in the matrix. The size of the separated particles reflects accurately the rate of cooling attained by the mass, and Fig. 1 shows how, in the case of hard spelter in accretionary form it can change quite suddenly the size of the crystal grains separated. The average analysis of this dross showed 3.5 per cent of iron which practically was united with the zinc, forming the higher melting point crystals which were the first to separate as the mass cooled, and 1.5 per cent of lead, not visible in the zinc-rich matrix etched black









On the right from top to bottom, Fig. 17—Twinned structure of annealed ferronickel, X 400. Fig. 18—Intercrystalline brittleness in gassed ferronickel, X 400. Fig. 19—Pine tree chystals in silver solder braze, X 500. Fig. 20—Distorted crystals in drawn silver solder braze, X 500

in the micrograph taken at 50 diameters.

Onion type of freezing suggested by Professor Howe in *Iron, Steel and Other Alloys*, is an almost ideal form of structure for certain purposes, but it is met with rarely in practical experience. About the only example known to the writer in his small amount of nonferrous metallography work is the alloy shown in Fig. 2 at 50 diameters magnification. In this view, the alternate layers of light and dark etching constituents are arranged distinctly in concentric formation, except where two or more crystallization centers mutually interfere and produce a double right-angled appearance shown at the bottom of the figure.

Forms Show Clearly

Needle-shaped spines and conglomerates of these into stars are common nonferrous alloy formations and show up more clearly when the matrix containing them is eutectiferous and thus of much lower melting point. Thus Figs. 3 and 4 show two zinc base alloys to which both aluminum and copper have been added in an endeavor to secure a suitable fuse metal. Data are detailed in Table I.

Specification called for a compression breaking load of not less than 60 tons per square inch whereas the metal did not quite come up to this. The elastic limit in compression, well over 20 tons for both above samples, was not called for definitely, but after a load of 8 tons per square inch had been applied, the cylindrical test piece must not show a reduction in length of more than 1 per cent.

As a measure of ductility and ability to forge, the specimen should not show any signs of cracking after it had undergone a 35 per cent reduction of length. In making the tensile test, the ductility, as measured either by percentage elongation or reduction of area, was not deemed sufficient, being only 1 per cent in each case. The alloy containing lead was still less ductile and only recorded 0.5 per cent elongation on the standard 2-inch gage length. Although these alloys were understood to be forgeable at 250 degrees Cent., it generally was found advisable to take them up to about 400 degrees Cent. It was necessary to heat them up slowly, first to about 250 degrees Cent. in an oil bath and then for a few minutes at the front of a gas furnace, before being stamped in the screw press, to obtain the rough forging suitable for subsequent machining.

The foregoing zinc-base alloys never were able to replace successfully the forging brasses for the purposes of fuse metal and four micrographs, Fig. 5 to 8 at 50 magnifications clearly show the differences between the grades of alpha brass and the several grades of alpha-beta brass around the 60:40 composition, all of which were forgeable but which possessd different degrees of machinability. Table II serves to compare the specified strengths of the several classes with the actually attained physical characteristics corresponding to the four different structures shown.

In the case of detent parts, the necessary physical properties rarely could be attained in the plain casting, and the necessary forging, after heat treatment, was needed to reach the high values shown under class *A*. Both *B* and *C* best could meet the requirements if the metal were melted carefully, without stewing, before being cast into chill molds. With moderate care the requirements of *C* could be met without this precaution, but as common scrap materials often were utilized in its manufacture, sufficient care was not expended in keeping the melt free from dross. The *G* metal used for the forging proper usually was cast best in a chill mold and in many cases the subsequent forging or press-stamping operation in the hot state imparted an elongated form to the constituents, similar to that often observed in extruded metal.

Discusses Bronzes

In tin and phosphor-bronzes which are used most commonly for bearing metals, one of the most important matters is to insure, apart from their soundness and freedom from blowholes, the proper structural arrangement of the primary copper-rich crystallites. These should form the interlocking type of arrangement and

Table I

Zinc Alloys with Aluminum and Copper

Fuse metal	Zn	Cu	Al	Pb	Tensile tons	Compression El. Lt. tons	Compression Ult tons	Hardness
Fig. 3	92	2	6	tr.	6	21	56	105
Fig. 4	92	5	4	1	15	33	58	.....

Table II

Correlating Mechanical Properties

Fuse Metal,	Class	E. L. Tons/sq. in.	T. S. Tons/sq. in.	E. per cent	R. A. per cent	Brinell hardness
Alpha brass, specification	A	20	30	20	.....	.....
Alpha brass, Fig. 5	A	20.4	40.2	23.5	23.1	170
Alpha-beta brass, specification	B	12	20	30	.....	.....
Alpha-beta brass, Fig. 6	B	13.2	30.8	32.1	27.2	110
Alpha-beta brass, specification	C	6	12	10	.....	.....
Alpha-beta brass, Fig. 7	C	10.8	29.2	16.8	19.0	120
Alpha-beta brass, specification	G	8	20	20	.....	.....
Alpha-beta brass, Fig. 8	G	9.4	28.2	29	32.9	105
In compression, Fig. 5	A	22.2	62.7	13	on 1 inch at fracture; and	

only 10 per cent reduction in length after the application of 40 tons per square inch.

Table III

Chemical and Mechanical Properties

Analysis of bronze				Physical Tests				
Fig. No.	Copper	Tin	Phosphorus	E. L. Tons/sq. in.	T. S. Tons/sq. in.	E. per cent	R. A. per cent	Brinell hardness
9	86.6	12.2	0.06	10.0	15.2	5.3	4.9	90
10	85.6	11.2	0.29	3.0	10.0	1.8	1.2	70
11	85.0	14.3	0.18	2.5	6.0	2.0	1.0	105

have the interspacial delta material in small, uniformly distributed and, if possible, isolated patches. Figs. 9, 10 and 11 show, with the accompanying physical tests in Table III the effect of attaining or losing this desired structure.

The structure shown in Fig. 9 is that of a well cast metal, the temperature having been suitable for the size of article involved. By contrast, the metal shown in Fig. 10 evidently has been cast at too low a temperature, and resulted in the suppression of the dendritic growth of the primary crystals. The eutectoid has formed an almost continuous network in spite of the lower tin content than the alloy in Fig. 9. In addition to being deficient in strength, this bearing would not stand up to such prolonged wear as the first. An exceedingly brittle arrangement of the constituents is the rectangular one shown in Fig. 11 which metal was not chill cast, as it might appear to have been. Such a bearing metal might stand up fairly well if put into service where no serious shocks were likely to be encountered, but even then the large amount of delta eutectoid present would be apt to promote scoring of anything less than a hardened journal.

When large percentages of tin are present, either alone or along with some residual phosphorus, there is a great tendency for some of this delta eutectoid to exude or ooze out of the casting, particularly from the riser and runners, as the metal cools and contracts. That this *white* metal is purely tin is proved erroneous by analysis, and when the particles are too small for analysis it is shown to contain other metals by the microstructure. Fig. 12 indicates the complex nature of this *sweat*, since, in addition to the ternary eutectic of copper-tin-phosphorus, quite an appreciable number of the dark-etching, copper-rich dendrites are present. Naturally, such pellets are exceedingly brittle, and indicate the extent to which segregation can occur within drawn places inside the casting.

Studies Aluminum Alloys

So many of these have been utilized in the foundry and fully described recently that it is not necessary to recapitulate those at the low specific gravity end of the diagram. Many avenues of the copper-aluminum alloys remain to be explored and an interesting case of the remarkable property some of these have of self-annealing themselves in the process of casting came to the writer's notice. A heavy-duty bevel wheel of over 300 pounds had been tried in several alloys until a mixture which contained copper, 83 per cent; aluminum, 10; nickel 6; and zinc 1 per cent finally was recommended and tried. A separately cast test bar was found to be similar in strength and structure to the risers of comparatively small section.

However, it was not until the machine in which the actual wheel was used was being scrapped that portions of it were examined for structure and the comparison is shown in Figs. 13 and 14. In the former at 50 diameters the structure is of the simple alpha-beta type, due to the comparatively rapid cooling. The larger mass, which had cooled more slowly showed the complete change possible in this type of structure due to self-annealing whereby the beta constituent can break down into either a gamma or delta eutectoid which forms the interspacial matrix around the primary crystals rich in copper, and in this case containing most of the nickel in solid solution. The minute nature of the particles in the eutectoid will be realized from the greater magnification of 200 diameters required to resolve it in the micrograph, Fig. 14.

Investigates Trouble in Copper

Apart from the harmful amount of oxygen sometimes taken up by copper when remelted from ingot form, there has recently been a crop of obscure troubles in refined copper, chiefly of American origin, which has been put down to *gassy* copper. A considerable amount of research work has been expended upon this matter and the result points to two causes; one of which is an excessive amount of oxygen present in the form of cuprous oxide and the second cause to copper with a more moderate amount of oxygen which readily became brittle on being heated in a reducing atmosphere. When copper is being refined, or even when electrolytic copper is being melted to cast it, cuprous oxide forms rapidly and is soluble to a slight extent in the molten copper. It should be removed almost completely by the poling operation and only sufficient left to control the *setting* of the open mold cast bars to produce the required level surface in the common *crimped* form. If too long a time elapses during casting and before poling is resorted again to there is a danger of an excessive amount of oxygen being taken up. This commonly shows itself in a layer near the top skin of the ingot or bar and in certain cases it even exudes as small pimples on the ingot surface. The analysis of such metal apparently may be all that is desired as it is somewhat difficult to estimate oxygen content, especially when so completely segregated, but the microscope reveals the harmful effect clearly. Thus Fig. 15 at 100 magnifications shows the easily recognized eutectic structure of copper with cuprous oxide in the copper ground mass. It also shows considerable masses of free oxide in slightly globularized strings occurring near the surface even after the copper has been reduced in size, and any possible excess scale given every opportunity of being removed. The only cure for this fault is better casting conditions and care in obtaining the correct casting temperature.

Oxide Is Reduced

The other trouble caused by gassing in a reducing atmosphere long has been known as the effect of reducing the copper oxide which occurs in less highly enriched copper as pearlitic patches of eutectic at the grain boundaries. This produces spongy material around the grains of copper and causes pronounced brittleness as the fracture always occurs between the crystal grains. A useful form of heat treatment recently has been devised to overcome this possibility of brittleness. The explanation for this is clearly shown in the micrograph, Fig. 16, which reveals the intergranular nature of the gaseous penetration. It has been found by S. B. Leiter, *Transactions* American Institute of Metals, Feb. 1926, that by a proper annealing, followed by slow cooling the cuprous oxide meshwork can be spherodized just like pearlite and balled up into tiny patches located throughout the copper matrix, without being in the grain boundaries. The gassing or heating in any reducing atmosphere no longer had any harmful effect upon the ductility of the metal, because where the cuprous oxide had been there only remained tiny holes in the metal lined with spongy copper. Since these blowholes were scattered through the metal in disorder, no brittle grain boundaries were found to exist and the trouble was eliminated.

Sulphur Affects Nickel Alloys

Extent to which nickel and its alloys can be rendered nonmalleable by oxygen is only slight compared with the astonishing effect which sulphur has in this respect. The former idea that the addition of magnesium had the effect of removing the oxygen now has been dispelled and the true case for the expulsion of the sulphur by

(*Concluded on Page* 235)

How and Why in Brass Founding

By Charles Vickers

Encounters Difficulties

Our foundryman has been getting indifferent results making an aluminum alloy sweeper nozzle, the trouble being the old one of dust-like specks showing on the casting when polished. We are using the best metal money can buy; make pyrometer tests for heat and have tried all the more costly fluxes to break up the oxides but so far the results are not uniformly satisfactory. We have changed our methods of gating with no improvement, and would like your suggestions, also the proper flux and the best grade of metal to use. We enclose a blueprint for your information.

As remarked in the inquiry, it is the old trouble for which aluminum alloys are noted: Porosity, which as far as can be now seen appears to be caused largely by dissolved hydrogen. The writer at one time assumed this to arise from a reaction between strongly heated aluminum and the moisture contained in the sand mold, the result of which was to split up the water into its constituents oxygen and hydrogen, the one combining with the aluminum, the other dissolving in it, but it is doubtful if this theory is the true one because there is no evidence of any high temperature, such as would result from the combination of aluminum and oxygen. In the effort to eliminate the hydrogen, or to dehydrogenize the alloy, sulphur was added to the melt, also selenium and tellurium. In the case of the latter addition some slight improvement was thought to be noted. Although the pouring temperatures were carefully checked by pyrometer, there is always the possibility that an imagined improvement might be due to some small drop on pouring temperatures. It is doubtful whether any flux is now available that can be relied upon to eliminate this condition of porosity.

We do know though that some alloys make better sand castings than others, and that castings apparently sound can be obtained by pouring the alloys at as low temperatures as it is possible. This has been known for many years. We quote from a paper presented by S. L. Archbutt before the Institute of Metals recently as follows:

"Coarseness of grain and pin-holing are accentuated in sand-castings by high pouring temperatures. If melting and pouring temperatures are kept low, considerable improvement can be effected in respect to these defects. Under the most carefully controlled conditions, however, employing normal foundry practice and treatment of melts, it has not been found possible at the laboratory to effect more than a certain degree of improvement in soundness."

The above tells the whole story; when the castings are so designed they must be poured with *hot* metal in order to run some thin sections, there will be a lot of trouble. However, this may be decreased by using the more fluid alloys containing silicon, as they may run at a lower temperature. We suggest a trial of the alloy: Aluminum, 93 per cent; copper, 4 per cent; silicon, 3 per cent; mentioned in THE FOUNDRY, Nov. 1, 1925, page 867. As regards the method of gating, it is not possible to give an intelligent reply unless the pattern itself could be seen and handled.

Wants Yellow Solder

We are making small manganese bronze propellers and have some difficulty due to small pin holes which occasionally appear on the surface when buffing. Can you suggest any way of filling these defects. Is there a soft yellow solder on the market which would be suitable for this purpose?

We never have come into contact with a soft yellow solder and feel skeptical about the existence of such a metal. There is, of course, brazing solder which usually is yellow in color and may be made white. It would be difficult to braze the holes that show on the castings, and might cost more than making the castings over again. Manganese bronze may be cast minus such holes and we believe that to be the most satisfactory thing to do. We are unable to assign any reason for the holes. As far as the metal is concerned, if the alloy is properly made there will be no blame to attach to the metal. While manganese bronze will shrink considerably and run dirty if not gated in the proper manner, it seldom makes porous castings. When it does we feel the molds are to blame, as they failed to allow the molten metal to lie quietly against the sand surfaces, a thing that is most essential in the case of this alloy.

Trouble With Pinholes

We are making automobile steering wheel spiders in aluminum alloy and experience difficulty with pinholes that show up in the hub and run about 1 inch out on the spokes. We have poured the castings both hot and cold, and have used chills around the hubs, without any better results. Can you suggest how we can overcome this difficulty?

Pinholes in aluminum alloy castings in nine cases out of ten, are caused by pouring the metal too hot. In this case it is claimed the castings have been poured both hot and cold with the same results. Evidently even the so-called cold pouring has been at too high a temperature, otherwise there would have been no holes around the hubs.

If the pouring temperature of the metal in this case is claimed to have no effect in causing pinholes; then how is it that the spokes a short distance from the hub are not also filled with holes? The only practical manner in which the pouring temperature of an aluminum alloy can be determined is by a pyrometer. Every casting has its own pouring temperature. Therefore, common sense suggests this is the first matter to be decided. The castings must run properly, but the metal must be no hotter than will insure the fluidity to completely fill the mold. In no part of the mold must the aluminum be permitted to *shiver*. Otherwise fine holes will be found, for it is gas that causes the agitation.

In the case at hand it can be assumed with certainty that the portion of metal filling the hub, does not sit there quietly. It shivers, or simmers. It may be the sand is a little close. For aluminum castings a fine open sand is needed. If it is possible to gate the castings otherwise than on the hub, this should be tried. The important thing is to use methods that will insure the metal remaining absolutely quiet after pouring otherwise faulty castings will result.

Bill Glances Back Over the Years

By Pat Dwyer

SINCE Bill quit the road and settled down more or less permanently he has lost track of many of the old boon companions with whom he foregathered in the days when any old place he hung his hat was home. He hates to write letters and as a consequence he does not require a secretary to attend to his correspondence. Occasionally he receives a letter from one of the boys and derives as much pleasure from its perusal as the ordinary citizen gets out of a brief message which says: Enclosed please find check for $37.43 on account of error in your tax assessment.

The letters he receives come from widely separated points. Some are from men who have been definitely located in one place for many years. Usually the writers have assumed positions of responsibility. They have married and settled down, raised families, bought homes and became aldermen or have been elected members of the board of education. Because a man has done some rambling in his youth and early manhood does not necessarily imply that he is a wastrel or that he is devoid of native ability. On the contrary, the fact that he is willing and anxious to fare forth in strange places and among strange people argues the possession of energy, initiative and a legitimate pride and confidence in his ability to stand on his own two feet without asking favors or assistance from any person. Whatever measure of common sense has been his at birth becomes developed to a higher degree of perfection as the years roll along. Contact with other men in many places and under all kinds of conditions gives him an intimate knowledge of human nature in the abstract and concrete. It rubs away the sharp corners, tones down any radical opinions and enables him to slide through the brief span of life with a minimum amount of friction.

Other letters come from men who still follow the lure of the open road. Natural born gypsies who never are happy unless they are on the go, north, south, east or west. I can't remember where I read it—what's the difference anyway—but some lad with a gift for setting down his thoughts in rhyme covered the ground so much more neatly and completely than I can do it that I am going to quote him right here:

Yonder the long horizon lies
And there by night and day
The old ships draw to home again
The young ships sail away;
And come I may, but go I must
And if men ask you why;
You may put the blame on the stars and sun
On the white road and the sky!

All shipshape and Bristol fashion and you may lay to that! Some captious critics probably may advance the objection that nautical references have no place in a discussion relating to foundrymen. They will claim that the bold boys who hopped the rattlers and dodged the dicks on every railroad system in the country always showed a marked aversion for water either for external or internal application.

Maybe so, maybe so. Life is too short to get involved in any argument over such a trivial point. The happy critic may get whatever pleasure he can from scoring a victory by default. The rambling Romeos and many others whose rambling has been done in imagination will know exactly what the poet had in mind when he blamed the stars and sun, the white road and the sky.

One of these letters, whether it comes from a home guard or a rolling stone invariably plunges Bill in a reminiscent mood and brings up memories of days and nights spent in the company of men who enjoyed the nearest approach to absolute liberty of any class living under civilized conditions. Under pressure he is willing to admit that civilized communities could not exist and function if every man followed the hobo instinct, but as he philosophically points out, many factors take care of this problem automatically. "Look at the beehive." He will say. "It always has been and probably always will be held up as an emblem of the most intense kind of well-regulated industry. You should read Maaterlink's *Life of the Bee* to get the absolute low down on these tricky little insects. Ap-

TOUCHING SCENES WHEN THE BOYS LEAVE THE OLD HOME

proximately 20 per cent of the gang never do a tap from the moment they are born until they finally are stung to death and thrown out of the hive. They have an easy life sipping up the honey supplied by the working class. They become disgracefully drunk before the close of each day and although they are stung to death, taken apart and dumped out of the hive eventually as so much rubbish or excess baggage, they probably die happy. A bee elegantly distended with free honey, pickled to the gills you might say, is in no mood to worry over trifles or to wonder where do we go from here." Bill came over the other night to show me a letter he had from one of the old time tourists, who quit the road many years ago and now is manager of a prominent foundry in a New England town. It will touch such a responsive chord in the memories of so many of the Old Guard that I am going to ask the printer to set the letter in a box. It may be news to some of the boys to learn that the foundry is not the only place where boxes are employed by the jolly heroes who are responsible for the long day's work.

COPPER LENDS ITSELF TO THE EXTRUSION PROCESS

"There's a lad," said Bill after I had read the letter. "Whom I haven't seen since July 1902 when we attended a convention of the International Molder's union in Toronto and had our picture taken on the steps of the city hall on Queen street. It was my first and last convention. I acquired a foreman's job shortly afterward and was automatically barred from further attendance. I often think of the old careless life and the free companions of the open road. Most of them first class mechanics, able and willing to tackle any job in the shop and to hold their own in any argument that arose either in the shop, on the road or in any of the rest houses that dotted this fair land before Mr. Volstead succeeded in hanging an empty tin can on the tail of the constitution. All most without exception the old boys were all around mechanics who required a minimum amount of supervision. One general foreman with the ability to carry a thousand details in his mind looked after everything, and did it well.

Recalls What Happened to Jim Dalton's Spike Tail

Dear Bill:

The writer has been a continuous reader of and subscriber to THE FOUNDRY *since the days when a double ender was given as a premium for each subscription. I always have enjoyed reading the publication, particularly the items which touch on the activities past and present of the old timers who were the backbone of the skilled craftsmen 25 or 30 years ago. Your remarks in the Feb. 1 issue, particularly where you referred to Big Jim Dalton's dress suit in which he made the rounds, hit my funny spot as no Charlie Chaplin or Harold Lloyd ever has succeeded in doing.*

About 27 years ago, in the spring of 1900 Jim blew into Schenectady, N. Y., and caught a job in the G. E. with Charlie Mohlman, one of nature's noblemen, who long since has passed to a well-deserved reward.

The greatest and most miscellaneous assortment of hoboes that ever graced a shop at one time were working there at the time. In addition to the writer and many other well known birds of passage the list included such famous national and international characters as Slim McComish, The German Carp, St. Louis Billy Galloway, Jim (Bo) Lanigan, Frank Murphy, Jimmy Webb, Mul-Cahey and Canadian Billy Smith.

Most of them were paying guests at the tourist resorts maintained by Dan Mahoney and Schoenich. Jim had the self same dress suit with him at this period.

One evening the gang staged a particularly happy and hilarious party in Charlie Strattman's place, one of the havens of refuge thoughtfully provided by philanthropic citizens, where thirsty molders and any other wayfarers who had the price could sluice their pipes and wash away the day's inward accumulation of grit and grime. Charlie was a perfect host and saw to it that his assistants kept the flowing bowl circulating merrily.

About 1:30 a. m, when the party was just going good the police raided the place and the guests tried to do a vanishing act. The slim boys oozed through a window, but when Jim, in a panic foolishly attempted the same route he stuck by the equator between the upper and lower sash. He was extruded finally through the combined efforts of the entire police squad, but he came out like a snake that has shed its skin. The famous dress suit was no more.

Keep up the good work Bill. Give us more of the old time stuff when molders were molders and the salt of the earth.

Sincerely yours,

EDDIE MORROW.

"I worked for over a year in a prominent foundry in the east that specialized in rolls and heavy machinery. Molds were made in green sand, dry sand and loam and the daily heat averaged 100 tons melted in four cupolas and two air furnaces. Activities of 90 molders and their helpers were supervised by one general foreman and an assistant who looked after the dog house. A working foreman had nominal charge of the coreroom and another man had charge of the melting arrangements. Castings were cleaned under the direction of a man who handled the job by contract on a tonnage basis. Believe me, every man knew his work and required neither pushing nor prodding. The general foreman may have been mentally busy, but most assuredly he was not worn to a mental and physical wreck darting hither and yon; 'Helping the hazy ones, coaxing the aisy ones or belting the lazy ones on with a stick;' like the famous Father O'Flynn of happy memory. Apparently he had all the time in the world to hold conferences with the general manager, with his assistants, with any man who wanted a ruling on any debatable point in equipment or methods. He hired the men and fired them or accepted their resignations with equal nonchalance and without either red tape or ceremony. Occasionally he invited an unfortunate lad who had lost a casting down to the cleaning room and presented him with a cigar, a delicate foundry sarcasm for bawling the pants off him.

HE HIRED 'EM AND FIRED 'EM WITH EQUAL FACILITY

"You don't find many of that kind of shops today even among the jobbing shops where the average all around skill of the molding force necessarily is higher than it is in the specialty shop where each man concentrates on one mold and in many instances only on one operation in the sequence of operations necessary to its production.

"Through a gradual evolutionary process that has been going on for many years the methods of producing castings have changed considerably particularly during the past 20 years. Mechanical equipment has invaded the foundry field to such an extent that a far larger production of castings is secured with a smaller number of men than formerly. I can remember when 30 snap flasks was considered a day's work in the ordinary jobbing foundry. Compare this with the output in a modern production shop where each molder turns out from 100 to 300 molds.

"Under former ordinary jobbing conditions a skilled molder might make three automobile cylinder blocks per day. In the specialty shop of today a gang of six men will make 100 to 150. These men merely ram the copes and drags, core and close the molds. Of course other men are required to handle many of the auxiliary features, but the point I wish to make is that only six skilled men are required. All the remaining work is taken care of by mechanical equipment and by common labor. Also the degree of skill required by the men who actually make the molds is rapidly acquired. Their sand is prepared, the flasks all fit accurately, the molding machines automatically regulate the density to which the sand is rammed, the cores require no fitting. In a word the men are relieved of nearly all responsibility.

"The field of the all around molder is becoming more restricted every day and as a consequence the supply of this class of mechanics is dwindling. A question that is agitating the minds of many jobbing foundry managers is whether the supply will hold out until the evolutionary process has progressed to a point where all around molders no longer will be needed.

"Even at present the situation is becoming acute and the supervisory force in many shops is out of all proportion to what was considered necessary many years ago. Usually a subforeman or instructor is required for every group of 10 men. The superintendent or general foreman has to attend personally to such a multiplicity of detail that he has little or no time to devote to the broad executive duties that legitimately should occupy his attention.

"I was in a general jobbing shop the other day that is operated in connection with a large industrial establishment. The man in charge is one of the molders of the old school who toured for many years in earlier days and worked in nearly all the prominent shops in the country where molders were molders and required little or no instruction or supervision.

"I never had met him, but his name was familiar and a few minute's conversation disclosed the fact that we had a host of mutual acquaintances and at one time or another had worked in the same shops. With this community of interest for a foundation he became confidential and deplored how he was handicapped in his efforts by the scarcity of skilled molders. Out of his entire crew of approximately 100 molders he said that he only had four men that he really could call molders. Extended experience under all kind of conditions and a natural ingenuity in devising simplified methods enables him to get an exceedingly wide range of castings with the assistance of the men at his disposal. The castings range in size and weight from small repair parts made on hand squeezers up to turbine parts in which some of the individual parts weigh 90 tons.

"Recently he was called upon to produce 20 ingot molds a day for the company's open-hearth department and he solved the problem in an original manner.

"With the exception of split molds which are molded and cast in a horizontal position, the universal practice is to mold and cast solid molds in a vertical position. He calmly ignored tradition, custom and long-established practice. The ingot job is handled as easily and nonchalantly as any little split pattern mounted on a board.

"The pattern 5 feet 6 inches in length, 2 feet in diameter is cylindrical instead of the usual rectangular shape. It is split in two, longitudinally and each half is mounted on a board. A plain flask without bars is placed around each half. Two men shovel sand into each flask and two men ram the sand with pneumatic rammers. The sand heap in the vicinity of the flasks constantly is replenished from a central supply by a grab bucket suspended from one of the cranes. An iron plate is clamped on each half mold and then it is rolled over and set down on an open

space on the floor where the pattern and board are removed and returned to the first position and the operation is repeated. The mold is sprayed with blacking, slicked and placed on the oven car. On the following day two men remove the molds, assemble them and turn them up on end to be poured.

"The fluted cores are made in halves from an oil sand mixture in a metal corebox mounted on a rollover machine. The coreroom runs on a double shift and one man makes 21 half cores on each shift. I never have seen better looking ingot molds. They are as smooth inside and out as the proverbial onion. Eventually the production is to be stepped up to 60 molds a day and our hero proposes to meet this demand by installing a sand throwing machine to do the ramming.

"I am afraid the old order is changing," said Bill. "The all around molder is losing his place on the floor, but he is as necessary as ever in a supervisory capacity.

Readers Comment

Note—Material appearing under this head does not necessarily reflect the opinion of THE FOUNDRY or of its editors.

Where Are the Molders?

To the Editors:

In the *Shakeout* of THE FOUNDRY for Feb. 1 the question is raised why don't we cast our statues and bells in this country. Well I'll tell you one of the reasons and that is that we no longer have the molders to make them. The class of molders who follow the statuary line is almost extinct. Expert molders are an actual necessity if the foundry owner expects to make any profit.

Between 1911 and 1919 I managed a statuary foundry for a prominent New York firm. We had that branch of the foundry industry studied to the finest detail and we could underbid firms who practiced the lost wax process, but we had to sail mighty close to the wind to show a profit on our operations. At one time I had five of the fastest statuary molders in the country working for me.

With a contract for three large statues on hand we advertised in four different cities for molders and the only response we had was from two near molders who came in and looked at the models. They went home for their tools and never came back notwithstanding the fact that we offered $10 a week above the established and recognized scale in that city.

At present I doubt if a dozen first class statuary molders could be found in America. When I resigned my position in 1919 a statuary molder was paid from $24 to $28 a week and he worked fast. Now you would have to pay him from $60 to $70 a week without any hustling, because the pay of ordinary molders in New York City and vicinity is $50 and over. Sentiment is all very well in its place, but a foundry cannot afford to work for sentiment.

August M. Roth
Richmond Hill, New York

Cast White Iron Balls in Metal Molds

Question: We have been trying to make white iron balls 6 inches diameter for a pulverizing mill, but without success. They do not stand up under the pounding action. Either they break in halves or pieces spall from the sides. We have tried feeding these castings through a riser and also have tried them with a 3-inch diameter hollow center. We will appreciate any assistance you can give us on this problem.

Answer: In a broad general way it may be stated that the two essential requirements of the castings are hardness and toughness. The first to resist the severe abrasive action in pulverizing the refractory material in the mill. The second to insure even wear all over the surface and a consequent long life. Unfortunately these two features of hardness and strength are inclinded to be antagonistic in cast iron. As the hardness increases the strength goes down and conversely as the strength increases the hardness is reduced. A compromise must be effected at a point that will insure maximum strength with maximum hardness. This is a point that must be worked out locally, perhaps by experiment and will depend on the character of the iron in the yard and also to some extent on whether the castings are made in sand or metal molds. Approximate analysis of these castings is: Silicon 0.90 to 1.20 per cent, sulphur 0.10 per cent, phosphorus 0.20 per cent, manganese 0.60 per cent, total carbon 3.25 per cent. Charges could be made up from several sources to meet this analysis, by drawing heavily on chilled car wheels, white iron scrap, malleable pig or scrap, and steel scrap.

Your attention is directed to two recent articles in THE FOUNDRY describing the use of all steel scrap in the charge for making ball castings. The first by Larry J. Barton dealt with an electric furnace process practiced at the works of the Consolidated Copper Co., McGill, Nev. The second is a paper presented by T. F. Jennings at the convention of the American Foundrymen's association in Detroit last October and describes the process by which he melts an average of 30 tons a day of all steel scrap in the cupola and pours it into a battery of iron molds to form grinding balls for the copper ore mills of the Utah Copper Co. The first article was published in the April 15 issue of THE FOUNDRY, page 308 and the second was on page 779 of the Oct. 1 issue. Castings poured in iron molds do not need to be fed through a riser. A small riser is needed to allow air to escape. The casting will solidify first next to the mold. The shrink hole which seems inevitable on the top of a ball cast in the sand can be prevented by turning the mold upside down immediately after the metal has set in the gate. For this reason the gate purposely is made small. If necessary it may be cooled with water.

Nominate Directors and Officers for A. F. A.

S. W. Utley, Detroit Steel Casting Co., Detroit and S. T. Johnston, S. Obermayer Co., Chicago, were nominated for re-election as president and vice president respectively of the American Foundrymen's association at a meeting of the nominating committee held in Buffalo, Feb. 25.

Those named to fill the five vacancies on the board of directors include A. E. Hageboeck, Frank Foundries Corp., Moline, Ill. and William J. Nugent, Nugent Steel Castings Co., Chicago, nominated for re-election and E. H. Ballard, General Electric Co., West Lynn, Mass.; H. Y. Carson, American Cast Iron Pipe Co., Birmingham, Ala. and W. D. Goldsmith, Newark, N. J., nominated for the first time as directors.

The nominating committee was composed of chairman, G. H. Clamer, Ajax Metal Co., Philadelphia, A. B. Root, Hunt-Spiller Mfg. Corp., Boston, and L. W. Olsen, Ohio Brass Co., past presidents of the American Foundrymen's association and R. F. Flintermann, Michigan Steel Castings Co., Detroit; Walter H. Holt, Pressed Steel Car Co., McKees Rocks, Pa.; William E. Paulson, Thomas Paulson & Son, Brooklyn; and Dan M. Avey, THE FOUNDRY, Cleveland. The latter four were elected by the membership of the association.

To Hold French Annual Foundry Convention

The annual foundry convention organized by the French Foundrymen's association will be held in Paris during the second week of September. This date has been chosen so that the convention may be held in conjunction with the international exhibition which will take place in Paris from Sept. 1 to 21. This exhibition will be under the patronage of the minister of commerce and industry and of the French committee of exhibitions, and will be organized by the Syndicat General des Fondeurs de France with the support of the Association Technique de Fonderie. The exhibition will cover raw materials, manufactured products, machinery, equipment and supplies. With the support of the ministry of public instruction, the high school of foundry and other technical schools will undertake to display technical exhibits. The social and welfare departments will be organized by the Association Amicale et Mutuelle de Fonderie, an organization closely related to the technical association.

The exhibition will be held in the new park just outside the old Paris fortifications. Exhibits will be divided into five groups, the first including raw materials, the second group including castings in iron, malleable iron, steel, and nonferrous metals. This latter group also will include machinery, such as machine tools, in which the main parts are cast. Group three will include the complete range of foundry equipment, supplies being considered as raw materials and included in the first group. Group four will be the technical exhibit comprising the displays of technical schools, the technical press, and the results of competitions. The fifth group will be that of social and welfare work.

Participation of Belgium, Germany and Czecho-Slovakia already is assured. Iron and steel industries of France are represented on the patronage committee by F. de Wendel, president of the Comite des Forges de France. The president of the organization committee is C. Dufour, president of the Syndicat General des Fondeurs de France; the vice president is Emile Ramas, honorary president of the Association Technique de Fonderie. Leon Thomas, president of the association will be the chairman of the convention. A special Belgian committee also has been formed with Jules Carlier, president of the Comite Central Industrial, as chairman, and including Paul Ropsy, president of the Belgian foundry association and of the international committee of foundry associations.

Further information may be obtained from the secretary of the Syndicat General des Fondeurs de France, 8 rue de la Victoire, Paris, France. The program of the convention will be issued at a later date.

Reduction of Defects in Steel Castings

(*Concluded from Page* 212)

the difference between profit and loss, and is a problem of every foundry.

The solution of this problem is an important task of foundry management, and like many other human problems can be more easily solved through co-operation in educating the customer to the necessity of castings of proper design, and pattern equipment of suitable construction; in securing the best available raw materials and determining the best possible combination of these materials, and in endeavoring to improve the personnel of their plants by training apprentices in research work to better the quality of the product by improving present methods of manufacture or devising new ones. Only by striving for ultimate perfection of product will defects be eliminated and the status of the industry as a whole advanced.

Presents Information on Pipe Industry

According to recent information received from Walter Wood, R. D. Wood & Co., Philadelphia, some of the data mentioned in the article, "Cast Iron Pipe Made in N. J. in Early Eighties" on page 51 of the Jan. 15 issue of THE FOUNDRY, are slightly in error. Mr. Wood presents the following corrections that are offered in the interest of accuracy.

John McNeal, father of Andrew H. McNeal and an employe of a small foundry in either Pennsylvania or upper New Jersey, was hired by R. D. Wood to operate foundries at Milville, N. J., around 1847. Late in 1867 or in early 1868, Andrew H. McNeal, a son, was placed in charge of the R. D. Wood & Co. foundry at Florence, N. J. They remained with the Wood company until 1871 when they left the employ of the company. Two or three years later McNeal and his son erected a foundry at Burlington, N. J., and the business of this plant flourished as mentioned in the article in THE FOUNDRY.

Control Temperature

(*Concluded from Page* 216)

there are four pit type and two car type electrically heated and four steam heated heat treating furnaces, all automatically controlled.

The electrically heated heat-treating furnaces, besides being equipped with automatic temperature controllers, also are equipped with absolutely independent recording pyrometers and temperature limit safety fuses. The advantage of the independent controlling and recording pyrometers is that in case anything goes wrong with the controller, the recorder shows just what treatment has been accorded to the load and the proper procedure can be determined at a glance. The temperature limit fuse is a safety device to cut off the power before the load is melted down and the furnace ruined in case the controller fails and the operator does not observe the condition in time to remedy it. The foreman of the heat treating department is required to observe the automatic control instruments and recording pyrometers every half hour and record the setting of the controllers and the temperature readings.

The steam heated furnaces are equipped with pressure regulators which maintain a uniform temperature in the chambers and in addition the temperatures of the chambers are recorded on a recording pyrometer.

These heat treating furnaces handle castings ranging in size from pistons and bearing caps up to motor bus frames over 6 feet long and produce a uniform temperature throughout the load to within ± 10 degrees Fahr.

Summary

This paper has been prepared to show why close control of the melting and pouring temperature in an aluminum foundry is so essential and what results may be expected of good pyrometric equipment properly installed, maintained and used. The make of instrument to be used must be decided by the purchaser and there is a wide field from which to make a selection. The manufacturer will furnish the complete equipment and full instructions for the proper installation. Detailed descriptions of a few special features such as the asbestos insulated quick reading couples, the special wiring diagram of an indicating pyrometer installation, pyrometer tube and holder, etc., have been included and if anyone desires to incorporate any of these features in an installation they are at liberty to do so, but probably will have to make them as they are not manufactured.

Designs Loose Pattern Parts-I

Practical Considerations in Constructing Loose Parts to Permit Easy Withdrawal of Pattern Are Suggested—Identifying Pieces

By Joseph G. Horner

SINCE a foundry pattern only can be delivered from the sand in a direction parallel with the axis of withdrawal it is apparent that the sides of the pattern must not present any obstruction to their separating from the flanking sand. A pattern must not be wider at the bottom than at the top nor have any portions projecting solidly from the sides into the sand. Projecting pieces generally are left fitted loosely in such a way that the main body of the pattern is withdrawn first. Loose parts left behind are drawn laterally into the space left by the main body. This is the most important and the most common type of loose pattern construction, but there are others.

Molders are familiar with the fact that it is much easier to withdraw a pattern part from the sand than to lift the sand away from the pattern. The delicate sense of touch, the *feel* is a keener guide in the first than in the second case. The pattern can be *humored* during its withdrawal, but a heavy mass of sand is not responsive. This is one of the main reasons why patterns are made in two or more parts. If it was not for the danger of breaking the sand during the molding process, patterns might be made as complete units or *solid*, to use the ordinary foundry term. Perhaps the largest group of patterns is that in which each pattern is divided into symmetrical halves. The second largest group includes a long list in which the main pattern is not jointed, but carries one or more loose pieces to be lifted with the sand in the cope.

In a third extensive group, suitable prints are attached firmly to the main pattern and later, dry sand cores are employed to form projecting members on the face of the casting. Practice of ramming projecting parts on a drawback plate is somewhat similar, although usually it is applied to large molds. A drawback saves the cost of making a corebox. In fact on many classes of molds, particularly those for statuary and ornamental work the drawbacks are referred to as false cores.

Considering first those patterns in which loose pieces project from the top, the center or the bottom, the position affects the manner in which they are attached. Strips near the bottom or part of the way down must be detachable, unless alternative methods are preferred. A strip located close to the top or within reasonable distance of the top usually is made fast and the parting line is brought down to it. This method only permits of limited application since the vertical face above the strip must be well tapered.

Strips Drawn In

Width of a strip and the distance it extends from the side of the pattern are important factors. Obviously where a strip has to be withdrawn laterally into the space left by the withdrawal of the main pattern, it must be narrower than the space. Occasionally where the width of the strip or other part exceeds that of the space by a small margin, it is split in two and removed thus in sections. Application of this method is limited. Sand in the vicinity is liable to fracture and is exceedingly difficult to mend on account of its awkward position.

Where the space left by the removal of the main pattern is ample,

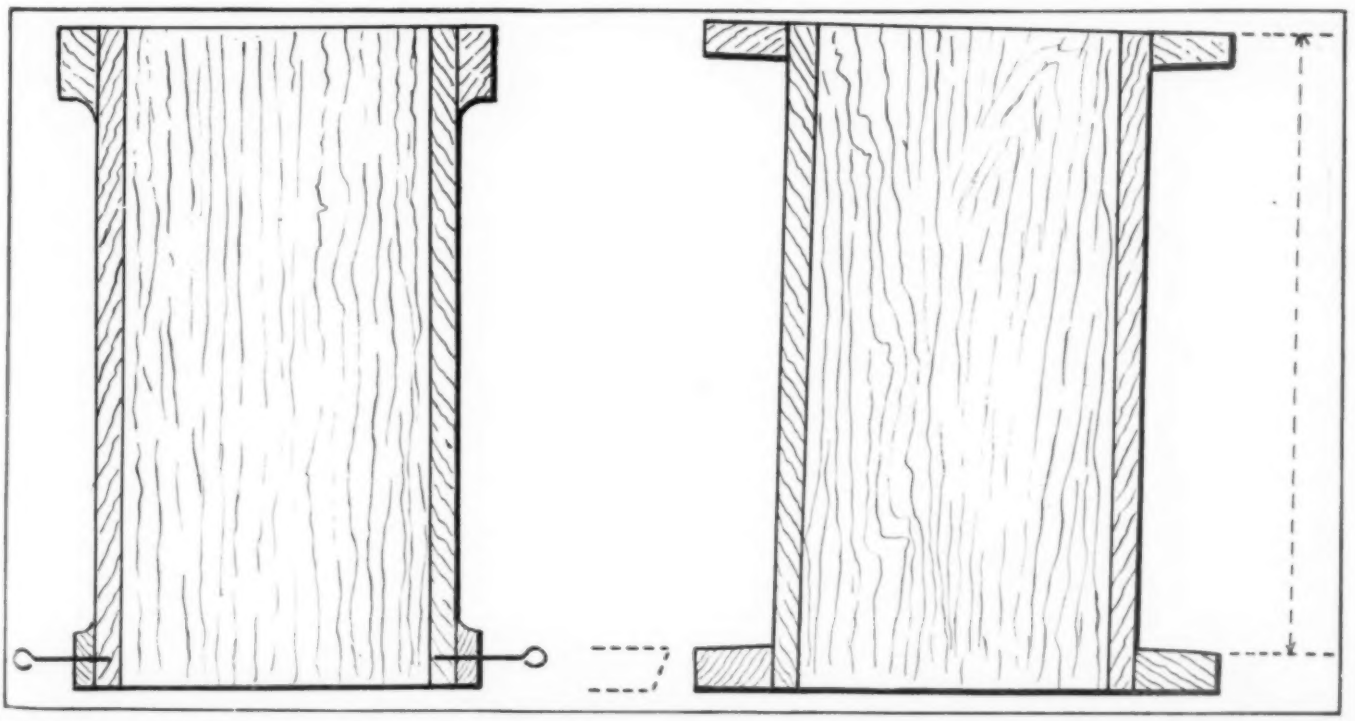


FIG. 1—TYPICAL PATTERN WITH A LOOSE RIB OR FLANGE AROUND THE LOWER END. FIG. 2—ALTERNATIVE METHODS FOR REMOVING THE LOWER FLANGE WHERE IT IS WIDER THAN THE EXAMPLE SHOWN IN FIG. 1

for example where the interior of the casting is to be formed with a large dry sand core, or where either the inner or outside body of sand is lifted away temporarily, comparatively wide strips or other projecting members can be delivered easily. The limit is reached at a point where difficulty is experienced in cleaning or mending narrow recesses.

Usually where wide strips of flanges appear at or near the bottom of a pattern, they are attached in such a way that the molder can make a parting in the sand joint along the upper edge. The main part of the pattern is removed first, followed by the intervening part of the mold. The loose piece in the lower part of the mold then is withdrawn easily, irrespective of its size or width.

Typical examples of deep patterns ribbed top and bottom are shown in Figs. 1 and 2. The top ribs present no problem and therefore are made fast, but those along the lower edges require consideration. If deep narrow webs have to be delivered, corresponding say, with the pattern sides in Figs. 1 and 2, the strips left loose along the bottom must be thinner than the spaces left by the webs as shown in Fig. 1. Even there the depth is almost too great to permit of their withdrawal with a bent wire. The method would be more practical if the webs were only half the depth shown. One of the methods suggested in connection with Fig. 2 is preferable where the ribs are too wide to be withdrawn laterally from the web spaces.

The simplest of three practical methods is to lift the internal body of sand away on a grid after the withdrawal of the webs and cross bars. This method provides ample space into which the ribs may be drawn laterally. The same condition obtains where the interior of the casting is designed to be formed by one or more dry sand cores. If the pattern leaves its own core, the exterior of the mold may be lifted away on a suitable plate as indicated at the left of Fig. 2, thus exposing the bottom ribs. Another way is shown at the right where the sand extending from the upper rib to the face of the lower rib is carried in a middle flask section. Choice of either method frequently is complicated by details and problems relating to other portions of the pattern.

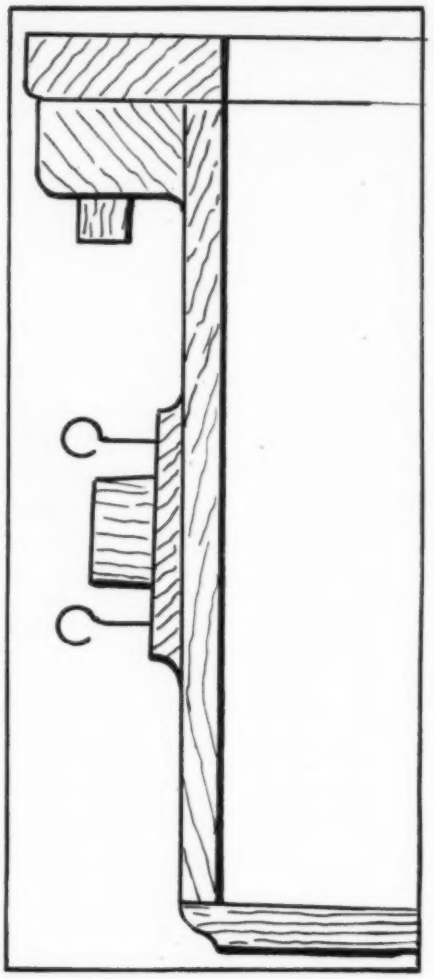
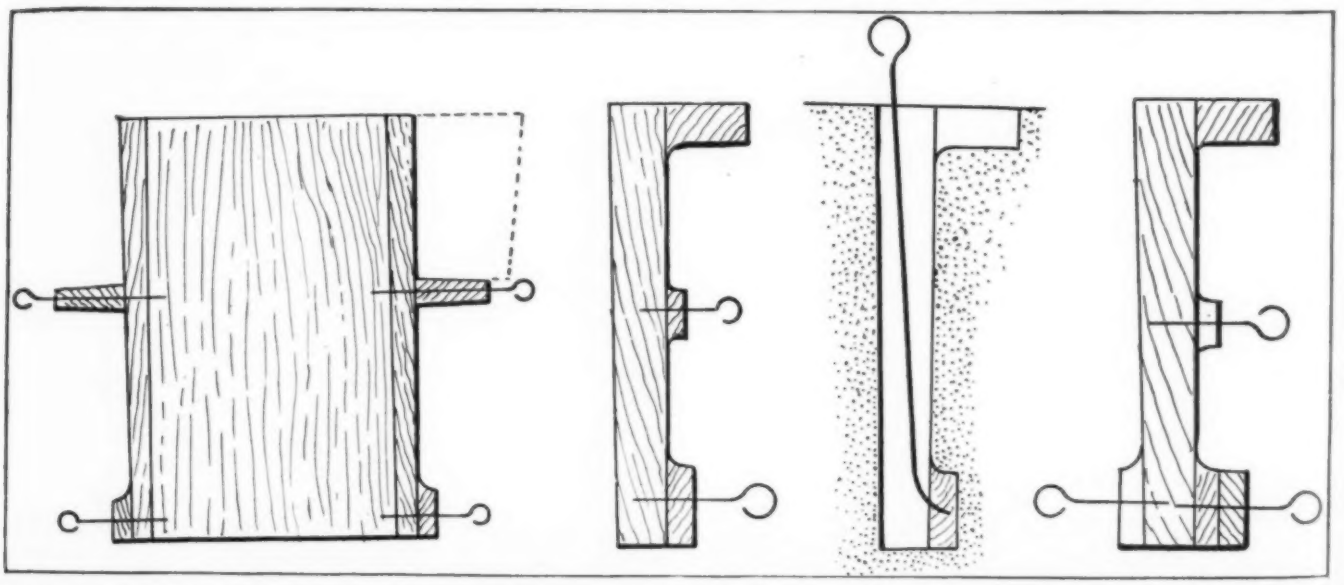


FIG. 3—LOOSE AND BOSS PRINT TO BE DRAWN INTO CENTRAL SAPCE

Strips lightly skewered that might just be drawn into the pattern spaces are shown in Fig. 4. The upper flanges cannot be treated in this manner. Unless a central space is available into which they may be drawn, the joint of the mold must be made down to the top face, a middle flask part or a drawback plate must be used, or the mold part above the flanges may be formed with a print and cores as indicated by the dotted line to the right. A web that is thick relatively to the loose pieces on the side, thus affording opportunity for their withdrawal is shown in Fig. 5. Method of employing a bent pricker to draw a loose piece into a web space is shown in Fig. 6. A thick rib divided in two for easy withdrawal is shown in Fig. 7. The thin rib shown on the inner side needs no division. Fig. 3 shows a loose boss and its print that is to be drawn into a clear central space left by the delivery of the interior. The round core afterward is inserted from the same clear space.

Method of joining loose pieces varies with the character of the pattern and the position of the parts.



FIGS. 4 AND 5 ILLUSTRATE THE USE OF SKEWERS FOR HOLDIN G LOOSE PATTERN PARTS IN PLACE. FIG. 6—A LONG WIRE WITH A BENT POINT IS USED TO DRAW A STRIP IN A DEEP MOLD. Fig.7—THE FLANGE ON THE LOWER RIGHT IS SPLIT IN TWO TO FACILI TATE REMOVAL

A LEXICON OF TECHNICAL TERMS

(*Continued from Data Sheet No. 660*)

Properties pertaining to or describing microstructures.

Pure metal structure
Solid solution structure
Eutectic structure
Eutectoid structure
Austenitic structure
Martensitic structure
Troostitic structure
Sorbitic structure
Pearlitic structure
Cementitic structure
Ledeburite
Ferrite
Graphite
Microconstituents
Etching

DEFINITIONS

Symbol

The symbol is a letter or group of letters used to represent an element.

Examples of elements found in the irons and steels:

Fe = Iron
C = Carbon —Principal constituents of iron carbon series.

Si = Silicon
Mn = Manganese
S = Sulphur
P = Phosphorus —Impurities from the ores, raw materials, fuels, recarburizers, and deoxidizers.

Al = Aluminum
Ti = Titanium —Along with Mn and Si are principal deoxidizers. Some of the ferroalloys are also powerful deoxidizers.

Ni = Nickel
Cr = Chromium
V = Vanadium
W = Tungsten
Mo = Molybdenum
Co = Cobalt
Zr = Zirconium
Cu = Copper —Alloying elements along with Si and Mn.

(*Continued on Data Sheet No. 662*)

Note—This sheet may be cut into two sections, 5 x 7 inches, and may be readily bound in note book form.

A LEXICON OF TECHNICAL TERMS

(*Continued from Data Sheet No. 661*)

Atoms, Molecules

Atoms are described as being composed of a small, positively charged nuclei surrounded by concentric layers of negative charges called *electrons* under a high state of oscillation. All substances are made up of *molecules*. These molecules are defined as the smallest mass of a given substance which can exist in the free state and maintain its physical and chemical properties. These molecules may be considered as made up of atoms of the elements arranged in some geometric pattern. Molecules, atoms, and electrons are so small it is impossible to weigh them, so many of them are weighed and the relative weights determined. Oxygen or hydrogen are usually used as the standard of reference. The *molecular weight* then is the relative weight of a molecule of one substance to that of hydrogen or oxygen or the sum of its atomic weights.

Atomic Weight

Atomic weight of an element is the relative weight of equal volumes as referred to either hydrogen (H = 1.000) or oxygen (0 = 16). This has been determined by weighing equal volumes of the gaseous compounds of an element and is always the largest even multiple of the equivalent weight which can be contained in the molecular weight of these gaseous compounds.

Equivalent or Combining Weight

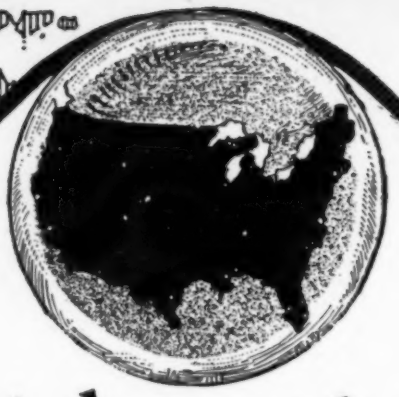
Equivalent weight is the weight of an element which combines with eight parts of oxygen or 1.008 parts of hydrogen. It has been noted by chemists that a definite quantity of every element or an integral number of times that quantity is used when combining with other elements to form compounds. This is called the *combining weight* and is the same as the equivalent weight.

Periodic Number

Chemical elements seem to have a certain relation between their atomic weights and their physical and chemical properties. It has also been observed that if the elements are placed in the order of their atomic weights that they seem to arrange themselves in groups. It has been found that starting with hydrogen as 1 that the first and the eighth element have certain similar properties. From this relation a table has been arranged called the periodic table. It is grouped in eight vertical columns and seven horizontal columns. By so grouping the elements, gaps have been noted in the series indicating elements not yet discovered. Because of this so called octant relationship, it has been possible to predict certain properties of elements before they have been discovered. The order in which an element occurs in this table is called its periodic number. Iron has a periodic number of 26.

(*Continued on Data Sheet No. 665*)

THE FOUNDRY DATA SHEET, MARCH 15, 1927
Payment will be made for all contributions on foundry and pattern shop practice suitable for publication



Seeing America with The Foundry

Little Journeys to the homes of our readers

CONNECTICUT has a total of 160 foundries of which
76 Melt Gray Iron
73 Exclusive Nonferrous
35 Nonferrous Depts. of other foundries
13 Melt Malleable Iron
8 Melt Steel
71 Melt Aluminum

CONNECTICUT popularly called the NUTMEG STATE, because of a legend that once an unscrupulous Yankee manufacturer made and sold wooden nutmegs, takes its name from an Indian term meaning (*long river*), referring to the Connecticut River, which flows through it from north to south. This territory originally granted to the Plymouth Company in 1606 is rich in history and the first trading post was established in 1623 at Hartford. A settlement at what is now New Haven was made in 1638 and the government was largely founded upon the Scriptures.

Connecticut is one of the leading manufacturing states of the Union. According to the government statistics it produces more than half of the brass products, more than sixty per cent of the clocks, nearly half of the hardware, over three-fourths of the plated and britannia ware and nearly sixty-five per cent of the needles and pins made in the United States. Besides these industries, others which have attained large proportions are the manufacture of rubber goods, textiles, including cottons, woolens and silk fabrics and machinery. New London has long had an extensive shipbuilding plant, where some of the largest steamers afloat have been constructed. The development of Connecticut's manufacturing industries is due to her favorable location in reference to large cities, to the abundance of water power and to the ingenuity of her people.

The factories of Connecticut produced an enormous quantity of small arms and ammunition for the armies of the United States and the Allies during the World War.

In CONNECTICUT—THE FOUNDRY has 192 paid subscribers.

"Wherever metals are cast you'll find THE FOUNDRY"

The most common method of attaching loose pieces on the outside of patterns is with wires or skewers looped at the outer end for the insertion of the finger. Sometimes, particularly in smaller patterns, wire nails are substituted. Whichever one of the three is used it must stand out well clear of the pattern part in plain sight of the molder so that he may remove it when a sufficient quantity of sand has been rammed around the part to hold it in place.

One objection to the employment of wires, particularly in standardized patterns is the risk of setting the loose parts in incorrect positions by inserting the wires in the wrong holes. However, this can be prevented by stamping the location of the part on the main pattern, by scribing around the edge or by painting the surface a different color at the area of contact. These precautions are highly essential where several short strips, lugs, bosses or core prints are loose. Misplacement of any one will result in a waster casting.

A good method to adopt wherever practical in standardized patterns is to attach loose pieces with dovetails. They obviate any risk of displacement. The dovetails are shallow. They fit easily but without slop. They are tapered freely so that the main pattern draws away easily and leaves the dovetailed loose piece in place in the sand.

Loose pieces should be stamped with the identifying number of the pattern of which they form a part. Unless the greatest care is observed both in the foundry and the pattern storage it is remarkable how easily loose parts may be omitted or lost. Wire holes get filled with sand and easily are mistaken for pricker marks. This is an additional reason why dovetails are preferable on parts where they are suitable.

Study Uses of Gas

No time has been lost by the American Gas association in getting under way the half-million dollar research program for the development of the industrial and factory uses of gas. As outlined by the association the research program will include investigation into the following fields: Food stuffs, nonferrous metals, forging, heat treating, drying, ceramic and miscellaneous heat operations. A test brass-melting furnace has been installed in a plant in Waterbury, Conn., and research will be conducted on the melting and annealing of nonferrous metals. A baking oven has been erected in the American Institute of Bakers, Chicago, and an oven furnace in a Chicago machine company.

Microscope Is Useful

(*Concluded from Page* 226)

magnesium has been demonstrated by Merica and Waltberg, bureau of standards, technologic paper No. 281. A remarkable similarity has been found recently in the working of some of the nickel alloys with that of copper. When being annealed, its ready embrittlement results in a structure exactly resembling that of *gassed* copper. One of the new alloys of ferronickel renowned for high magnetic permeability, shown in Fig. 17, illustrates the normal structure of tough and ductile metal when it has been annealed properly. Whenever the temperature is sufficiently high, and gassing conditions prevail, then the surface is converted into a mass in which the grain boundaries are embrittled and differ considerably from the normal metal. Such a state of affairs is shown in Fig. 18, which deleterious effect can be removed only by strong chemical or mechanical means when the unattacked portion retains its customary properties.

Use of Silver Alloys

One of the most useful applications of this semiprecious metal to engineering purposes is in the preparation of the so-called silver solder, which consists of a brazing metal to which a varying proportion of silver has been added. This series of alloys gives rise to some of the most interesting forms of eutectic structures which are capable of numerous modifications. In the usual variety for high conductivity work, the percentage of silver added is usually 8 per cent and when used in conjunction with copper, the initial copper-rich crystallites formed generally are well marked and contiguous to the joined surfaces. Further in as shown in Fig. 19, the tree-like forms of these crystallites have free scope to develop in the silver-zinc eutectic, which can form beautiful patterns, most of which are highly ductile for such a material. Thus when the cross sectional area of the braze has been reduced considerably, the deformation figures of the copper rich crystallites and the surrounding eutectic are often grotesque, but indicative of strength and unlikelihood of parting company, as seen clearly in Fig. 20, which like the former micrograph has been taken at 500 diameters magnification and shows the copper base with the solder attached.

Enumeration of cases in which the microscope can prove of unestimable value to the nonferrous metal worker is almost endless. It is hoped that the present selection of instances and illustrations will serve to assist those who yet have not contemplated seriously the installation and continuous application of a reasonably good microscope and wherever possible a serviceable photographic outfit to practical purposes. Knowledge gained in this way cannot be equaled by that obtained in any other direction and is most fruitful in attaining better results when applied in common-sense manner.

Is Ford Recipe

(*Concluded from Page* 208)

of Cincinnati developed a system of education to co-operate with industry. Under this arrangement students attend classes at the university for a stated period and then work in some factory for a like period. When one student returns to school another takes his place in the factory. The plan has proved popular and with modifications has been adopted elsewhere. About 200 students work in the plant of the Ford Motor Co. under similar conditions.

Students from the University of Detroit and Detroit Institute of Technology alternate shop and class work every two weeks. Students from Antioch college alternate on a 5-week period. The university of Cincinnati has a shift of four weeks. Students from the University of Pittsburgh and the University of New York change every three months.

Altogether over 4000 students of one kind or another are working and studying in Ford's various Detroit plants under the direction of 160 teachers and instructors. Payments to students and teachers total nearly $5,000,000 annually.

The school is under the direction of F. E. Searle who with his immediate corps of assistants occupies a suite of offices on the ground floor of the main building shown on page 206. The superintendent's office is plainly furnished in keeping with the spirit of simplicity and opposition to any form of ostentation or empty show which characterizes the head of the vast Ford enterprises. The only ornaments are a beautifully executed photograph of Mr. Ford and a framed reproduction of the famous quotation that has been attributed both to Ralph Waldo Emerson and Elbert Hubbard. "If a man can write a better book, preach a better sermon, or make a better mousetrap than his neighbor, though he build his house in the woods, the world will make a beaten path to his door." No comment is necessary.

Restore Molding Sand Bond

Veteran Foundryman Recounts Early Experiences in Attempting to Reclaim Foundry Sand and States That Many Modern Claims Cannot Be Sustained

By Walter F. Prince

PERUSAL of the technical press and visits to many foundries have shown me that the subject of rebonding old sand is receiving a great deal of consideration. As one of the largest users of molding sands for many years, I would like to express my opinion on the subject. During the period I had charge of the International Steam Pump Co. foundries, we consumed such large amounts of sand that an investigation became necessary not only on account of purchasing new sand, but to take care of the old sand. Trying to use the old sand entailed a continual loss. Heaps kept building up until we were deprived of molding floor space. As the sand became old, production fell off. I always considered a well tempered heap the cheapest.

Returns To Original Method

With a well-equipped laboratory back of me, I started to rebond old sand, to try to bring back a life and bond equal to that introduced by new sand. After experimenting for many years on hundreds of thousands of tons of this sand, I gave up the attempt and went back to the old original method of introducing new sand. I realize that although I may not have found the secret, the new school of foundrymen in a better position may have been more fortunate. I have waited for and read of development in this line with great interest, but after several years of waiting I do not find a satisfactory answer or method for reclaiming old sand. In my opinion it is a dangerous subject. A principle is involved and to accomplish results we have to live up to this principle.

A grain of sand under a strong glass resembles a sponge full of small holes. When two or more grains come together, unless they are bonded, they are like ordinary gravel or beach sand grains with no bonding qualities. The same grains of sand bonded together become loam or molding sands. These grains absorb a film, which joins and holds them together.

A molder would not think of trying to apply a coating of loam to a face of burned brick, to a hard close brick, to a brick covered with oil or even to a wet or frozen brick. He chooses a soft open brick so that when the wet mud or loam is applied the soft brick acts as a sponge and sucks in the mud. The water evaporates and leaves many fine films of dried mud which have been sucked into the porous brick. The strength of the bond depends on the material sucked in and the absorbing capacity of the brick.

Bonding material was found to be best when containing the highest per cent of aluminum oxide. Clean sand absorbed bond most readily.

In bonding core sands we found we could bond a clean washed sand with 100 parts of sand to one part of linseed oil and get as good results, as we could by using old or dirty or loamy sands down to 35 parts of sand to one part of oil. In all experiments we found the bonding strength in accordance with the cleanliness of the sands. One might say we found our bonding quality in alumina. The question then naturally arose, why not use clay to get this bond? We found we could do this but the sand soon lost its absorbing qualities. Why?

Many Experiments

Examination of the grains of old or black sand showed that the grains were filled with carbon or fine dust. Apparently here was the trouble. The old grain of sand saturated with carbon and not soluble in water could not absorb either water or bonding element.

Resorting to the pan grinder we secured fair results. Constant grinding and cracking open of the sands presented a new and clean surface where absorption could take place. This was satisfactory for core sands and dry sand facing, but too expensive for the green sand heaps. We also found that the addition of coarse new sand occasionally was necessary as the heaps began to show too close a composition.

All loamy sands do not make suitable molding sands. Molding sand to be of the best must have certain qualities which other sands do not have. In an attempt to develop a long life bond, I experimented with all sands which I could obtain from every section of the country. In a flask 20 x 20 x 20 inches I cast a cube 6 x 6 x 6 inches each night. Each

Had Varied Experience

THE author, W. F. Prince, bases the accompanying comment on nearly half a century of foundry experience during which he has filled every position from apprentice boy to consulting specialist. Forty-five years ago he first entered the foundry of Davis & Furber, North Andover, Mass., and shortly after he finished his apprenticeship he was appointed foreman in the Joceyln Foundry, Lawrence, Mass. He had charge of the Noble foundry in Lynn where the castings were made for the old Thompson-Houston Co., and later for the General Electric Co. He managed a foundry in South Boston until 1896 and then was appointed foundry superintendent of the Henry R. Worthington foundries, Elizabeth, N. J. When the International Steam Pump Co. was organized he was made general superintendent over all the foundries operated under the consolidation; the Henry R. Worthington Co., Brooklyn, N. Y.; Blake & Knowles Co., Cambridge, Mass.; Dean Steam Pump Co., Holyoke, Mass.; Snow Steam Pump Co., Buffalo; Hawley Mfg. Co., Lockport, N. Y.; Laidlaw Works, Cincinnati. What is claimed to be the first two-story gray iron foundry was built under his direction in 1902 for the Henry R. Worthington Co. at Harrison, N. J. He was one of the first foundrymen to install molding machines and operate them on a commercial basis. He holds United States patents for melting chips in a wrought iron tube; on a wooden stripping plate and a process for removing sulphur from molten metal. Eight years ago he resigned his position and since that time has engaged in general foundry consulting practice.

block was cast as near the same temperature as possible and remained in the mold until morning. Each day the sand was wet with the same amount of water and a box 12 inches long by 2 inches square was filled with this sand and jolted a given number of blows. The sides then were taken away from the box and the sand block was shoved out over the edge of the box until it broke of its own weight. The distance was measured each time for comparison. Each grade of sand was analyzed before and after the trial. I have not the actual figures now but the best results were obtained from sand with a low vegetable and a high alumina bond from the Albany or North river territory. Western sands showed lower alumina and higher vegetable bond. They appeared sticky and good but they went down in proportion to the aluminum oxide they contained. I cannot give the exact number of heats. These tests were made over 10 years ago and after satisfying ourselves we considered the record of no further interest.

However, and merely quoting from memory the tests showed about the following proportion: North River sand stood up for about 20 heats and contained about 12 per cent aluminum oxide. Jersey and many western sands went down in from 5 to 15 heats. By going down after a certain number of heats is meant the bond disappeared and the sand would not hold together with the given amount of water.

We then resorted to the use of old sands bonded with clay. Jersey red clay was found to be high in alumina. No trouble was experienced in bonding the old sand for one or two heats, but it was necessary to add new clay after each heat. A greater amount of water was needed to secure a satisfactory bond with clay and old sand than where new sand was employed. As we used the sand over and over we were compelled to increase the amount of water. After experimenting for over a year, artificial bonding was abandoned and the green sand heaps were rejuvenated in the usual manner with new sand.

I do not want the foundrymen at large to think I do not approve of trying to rebond old sand or that I feel satisfied that I did everything possible in the effort to find out how to do it. We are living in a progressive age and each day we are finding many new principles. I do not want to be considered an authority on this subject or to give the impression it cannot be done.

I do want to be of some assistance to many foundry foremen who I believe are being pushed into this sand question, before it is time. The same thing happened in the days of early melting with coke. Many articles were written on the amazing amount of iron that could be melted with a small amount of coke. Many good foundry foremen lost their jobs because they could not produce good castings at a ratio of 10, 11 and 12 to one. Owners and managers read reports of those who claimed to be doing it and the foundry industry all over the country was stirred up trying to accomplish similar results. All the conditions never were described. The conditions were not the same in every shop. Probably from first to last millions of dollars have been lost in bad castings and in the breaking up of well organized foundries in a vain attempt to accomplish what a few led us to believe they were doing. All this took place over 30 years ago, but the results that were claimed and broadcast have not yet been accomplished. Incidents of that kind cause a great deal of trouble and a great loss in money.

Sand Is Not Satisfactory

Many a good foreman, after reading of such results, tried to accomplish them. Many an owner or superintendent has compelled his foreman to melt at a ratio of 10 to 12 to one and the results were poor castings, excessive loss in all direction and finally a dismissal of the foreman.

I believe we are entering into the same condition with our sand. We read where one foundryman is using his o'd sand over and over with perfectly satisfactory results. In a recent issue of THE FOUNDRY, one man reports he is obtaining better results from old sand than from a regular heap. Is it not possible that the conditions which exist in these shops differ from average foundry practice?

For illustration, a short time ago I listened to a report on the bonding of old sand. I took it upon myself to visit that plant. I was taken to the floor where this sand was being used and the molder informed me the sand was all right for flat backs but he could not cope anything with it. This foundry has been experimenting for over a year with bonding old sand. The foundry superintendent has written many articles on how it was done and the good results obtained. I found he only had this sand on one bench floor and the molder informed me it was a rotten heap. I have visited many other foundries where the management wish to convey the idea that they have found the secret. In every case it has been the same old story. They had a few floors working or a special condition allowed them to use this sand. When asked why they did not adopt it on all floors throughout the shop I was told some condition prevented. The socalled jobber on crooked work didn't care to use it. It did not allow him to work fast enough. It would not cope. Others didn't use it because it had to be worked wet and so caused trouble. Shops producing great days works and paying the lowest price for piece rates did not consider it.

My reason for writing this article is to defend many good foundry foremen who are liable to be considered not competent by owners or superintendents if they cannot accomplish impossible results. Many good foremen who are anxious to keep up with the times, who try to accomplish something and who find they are losing a lot of money, become discouraged.

My advice would be to appoint a committee to investigate each shop that is experimenting. Have the committee publish the reports of conditions as they find them after taking all conditions into consideration. We want to save this old sand, we want to progress, but we do not want to fool ourselves and cause trouble and hardship on a misrepresented condition.

Pittsburgh Foundrymen Hold Meeting

Because of the widespread interest in the subject of apprentices, a large attendance greeted Dr. Walter B. Jones, research professor of vocational education of the University of Pittsburgh, at the February meeting of the Pittsburgh Foundrymen's association, held at the Fort Pitt hotel Feb. 21. His subject was "The Training of Patternmaking Apprentices" and various methods for training were outlined in an interesting fashion.

Dr. Jones was graduated from the public school of Trafford, Pa., and served his apprenticeship at the plant of the Westinghouse Electric & Mfg. Co., in that city. In 1917 he was graduated from the Carnegie Institute of Technology in the industrial teacher's training course. He since has had a number of years experience as a teacher in the Pittsburgh public schools and has also been an instructor in the college of industries at the Carnegie Institute of Technology. Dr. Jones received his master's degree from the teachers' college, Columbia university, New York. Since February of last year, he has been professor of vocational education at the University of Pittsburgh.

Patternmaker's Gouge a Major Turning Tool

By Walter C. Ewalt

WHEN turning wood in the lathe, the patternmaker uses hand tools far more often than the rigid or fixed tools fastened in the tool post. Often the nature of the work requires that both types of tools be used on the same job. Wherever it is possible to make better time with the fixed tool and carriage, that equipment should be used. When making a straight cut, a truer and just as finely finished piece may be obtained in less time with the fixed tool. Knowledge gained through experience should determine the type of tool that may be used to best advantage.

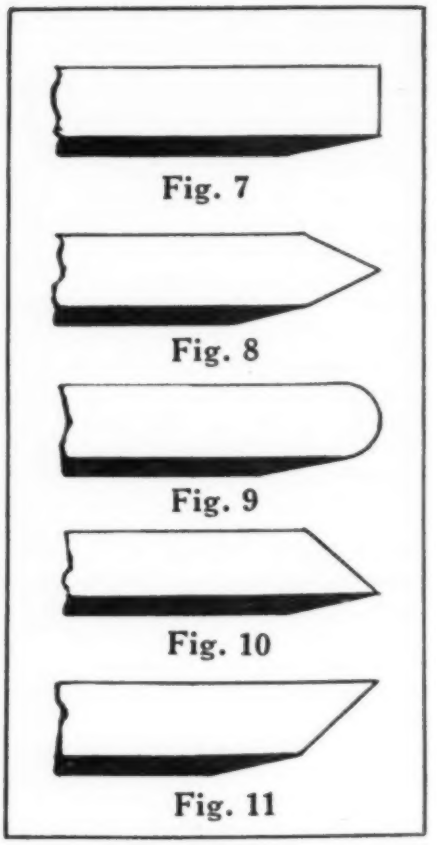
Types of hand turning tools are shown in the accompanying illustrations as follows: Fig. 1, the gouge; Fig. 7, straight edge or square point; Fig. 8, spear point or diamond point chisel; Fig. 9, the round nose; Fig. 10, the right skew; Fig. 11, the left skew; Fig. 2, the double edge skew or chisel skew; Fig. 3, the parting tool; Fig. 4, the hustle chisel; Fig. 5, the tooth plane iron and Fig. 6, the sizing tool. These tools may be obtained in many different widths and other types of tools may be obtained for work requiring special kinds of tools.

The gouge and the single and double edge skews are cutting tools, while the remainder of the tools are used for scraping. The gouge may be used both for the roughing and finishing operations. It is used as a roughing tool in the first operation to reduce the work to within 1/64 to 3/64-inch of the diameter desired.

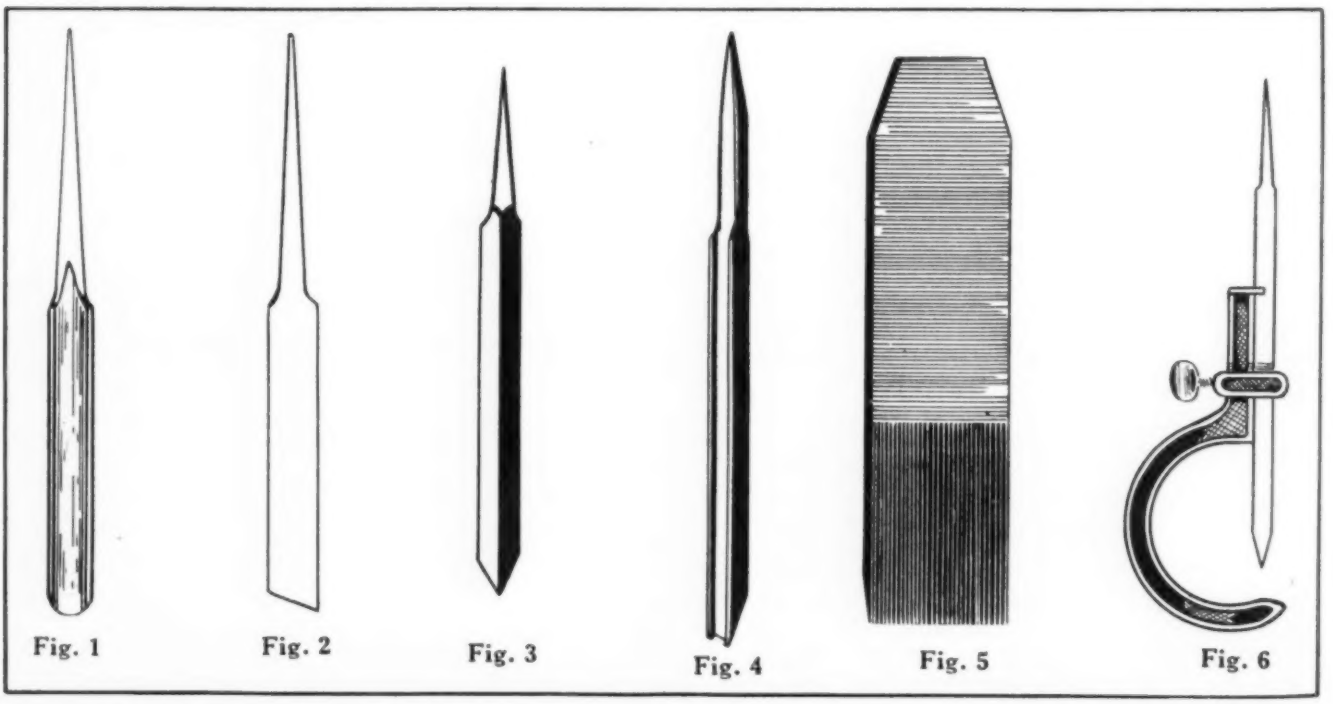
Tools Should Be Sharp

If tools are to work efficiently and produce a smooth finish, they should be ground with good, straight bevels. The length of the bevel produced in grinding varies with the individual. Some woodworkers prefer a bevel ground back while some wish a shorter bevel. After a certain point, a long bevel weakens the cutting edge as it leaves a long thin section which may be broken off easily when in use. The necessity for cutting both hard or soft woods, such as pine or cherry, regulates the bevel used. It is obvious that the longer bevel will hold up better in the soft woods than will be the case in cutting hard woods. A bevel that will cut both hard and soft woods efficiently should be determined by experience.

The bevel may be ground in a groove hollowed out in a grindstone, as shown in Fig. 12. The shape of the bevel may be seen in Fig. 13. When it may not be a good policy for various reasons to make a groove in the stone, the bevel must be ground by rolling the tool around from one side to the other. The burr caused by the grinding may be removed from



Figs. 7 To 11—Tools Used For Cutting and Other Operations



FIGS. 1 TO 6—VARIOUS TYPES OF TOOLS USED BY TH E PATTERNMAKER IN TURNING WOOD ON THE LATHE

the rounded edge of a stone used on the concave side.

Long handles should be used on turning tools, a handle 10 inches long being considered a good size. Many patternmakers use cutting tools with a cutting edge at each end and a handle with a slot which may slip over either end. This type of tool is considered dangerous by some patternmakers. It is unsafe to use either the double ended or the single end tool without a handle.

Hold Gouge Steady

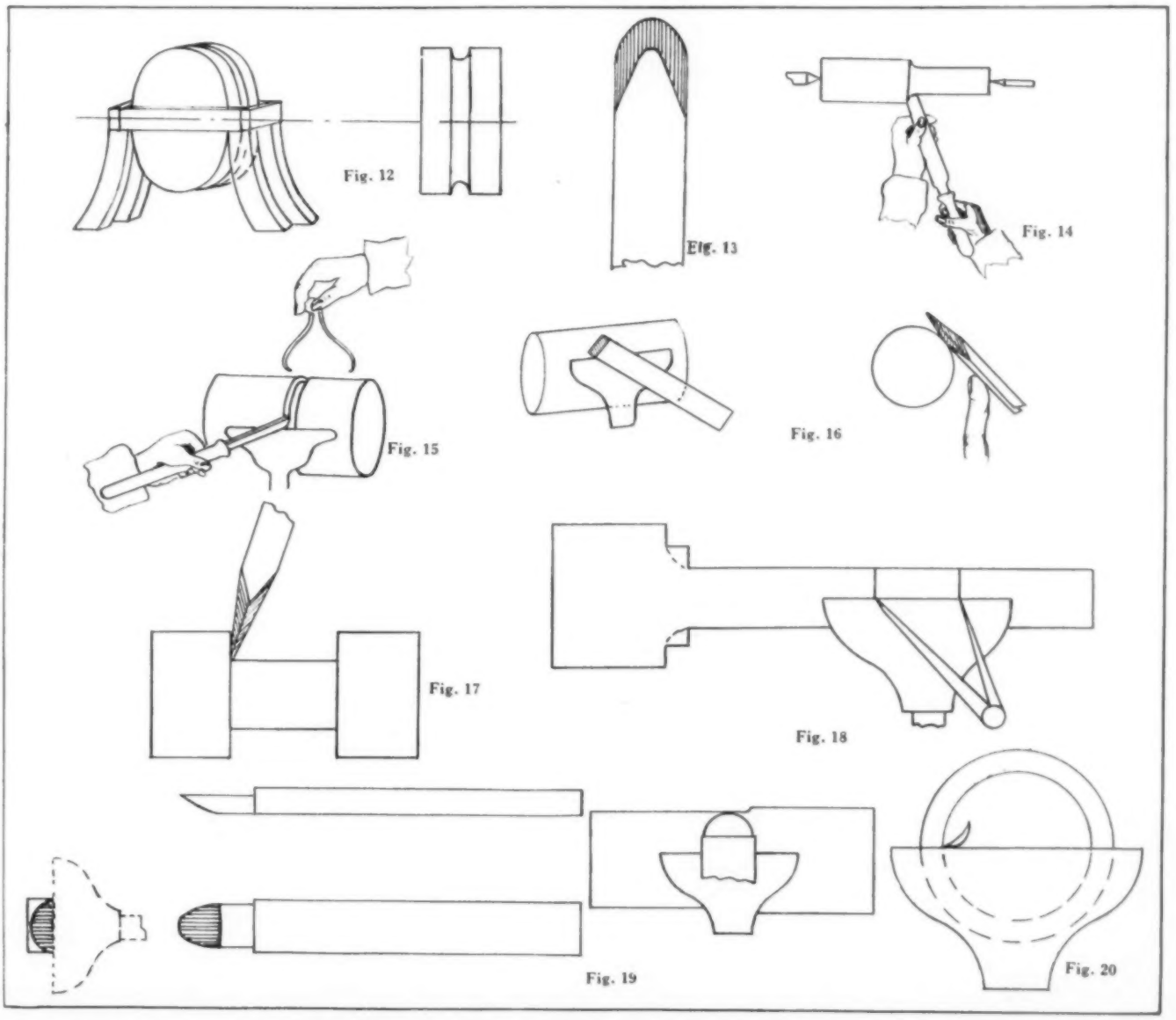
The gouge is held as shown in Fig. 14 when making a cut. As may be noted, the long handle extends back under the forearm. The tool may be held steadier in this position than if the handle was held only in the hand. If the handle is held in the hand without the brace of the forearm, a large shaving or chip may cause the wrist to bend and perhaps pull the tool into the work. The correct position of the hand also is shown in Fig. 14. The thumb should rest on top while the fingers grasp the handle near the ferrule. The other hand holds the tool firmly but lightly against the rest. The first finger of the hand is placed against the rest to act as a guide.

When passing the tool from one side of the rest to the other, the hand sometimes is placed on top of the tool and the little finger acts as a guide. Usually one hand acts only as a guide since the action of the work when turning holds the tool against the rest. However, there are times when it is necessary to change the position of the hand at the rest. Instances of this kind may be found in making grooves or turning off intermittent pieces of work such as the arms of a pulley or the teeth of a gear. In such cases the little finger and the thumb hold the gouge while the remaining fingers grip the under part of the steady rest. It is obvious that it is rather difficult to work under this condition and therefore the method of holding the tool is used only when it is not necessary to move the tool far sideways.

Place Rest Near Work

The steady rest should be placed as near the work as possible at all times. This does not mean that the rest should be moved with every cut across the work, but if the rest is not more than a half inch from the work, the tool probably will not be pulled into the work. Of course it not always is possible to keep within that distance, as in large rough work, it may be considerably more. However, in such cases, more care will be required in holding the turning tool or it may be jerked out of the hand.

In starting the roughing cut with the gouge, the tool is pushed into the



FIGS. 12 TO 20—METHODS OF SHARPENING THE TOOLS, HOLDING THE TOOLS ON THE REST AND LAYING OUT THE WORK ON THE LATHE

work a short distance from one end, making a light cut. The tool then is moved sideways from one end of the work to the other until the work is round. Some patternmakers turn the two ends round first, and then round out the center portion. As the work is cut almost to the diameter wanted, it is necessary to tell when the correct amount has been removed. This may be accomplished by stopping the lathe, or if that takes too much time, by placing the hand lightly on the revolving work, to feel the flat places. However the hand should be placed on the revolving work carefully so as not to catch the fingers in any way. After some experience, this is probably the way most wood turners tell when the work is round.

The gouge may be worked from right to left or vice versa and should not require the changing of hands. The position of the cutting edge should be slightly inclined as in Fig. 14 which shows the gouge cutting from left to right. It will be noticed that the cutting is accomplished with the lower side. If the edge is held high, it will turn and force the tool into the work. This may be seen in Fig. 15. The steady rest may be placed somewhat above the center during this roughing cut and as the work becomes round, it should be placed so that the cutting edge of the gouge is directed toward the axis of the work.

Measure With Calipers

After the work becomes round, the calipers are set about 1/16-inch larger than the required diameter. If the work is large, it will become necessary to stop the lathe from time to time, to measure but in smaller work, the gouge may be held in one hand and the caliper in the other.

The work is cut with the gouge at several places and measured with the calipers until the desired diameter is secured. The stock then may be removed between the calipered places. The operator must be careful when using a gouge to bore out a hole. In fact it is better to use a round nose tool for this work. Fig. 20, shows that the slightest chip or unevenness in the wood may cause the upper part of the cutting edge of the gouge to turn into the work, thus spoiling the work and perhaps injuring the operator.

A sizing tool is better than the gouge for cutting to the required diameter. This tool is a narrow chisel and used when turning and calipering at the same time, as previously described. The method of using is shown in Fig. 15 or when used with smaller work, the tool shown in Fig. 6 is convenient. While the gouge may be used to turn grooves, it seldom is used by the patternmaker for that purpose. Generally he uses a round nose as shown in Fig. 9, since this practice is much safer.

The skew chisel shown in Fig. 2 is an excellent tool in the hands of a professional wood turner. In fact, the gouge and skew chisel are practically the only tools necessary for artistic wood turning, such as making table legs, chair rungs, etc. The finest finish across the grain is obtainable with the skew chisel, since the fibers of the wood are cut, not scraped.

Used by the Patternmaker

However, not many patternmakers use this tool in the same manner as the artistic wood turner because it is difficult to turn the work to exact diameters required in patternmaking. In using the skew chisel for artistic work, the steady rest is raised almost as high as the top of the work and the bottom corner of the chisel slides upon the rest. The chisel is held about 45 degrees from the axis of the work and the lower part of the cutting edge engages the work. The bevel of the cutting edge, at the point where it cuts, should almost rest upon the work, as shown in Fig. 16.

However, the skew chisel has a place in the patternmaker's kit as a tool for making V and square grooves or in cutting down the ends of core prints, etc. The point is used in these cases to cut a small amount alternately on each side of the line. Care must be used not to take off too much at a time or the temper will be drawn from the tool. As the groove becomes deeper only the point of the chisel should be engaged, since if the entire cutting edge is used, the heel will be drawn in and the work spoiled, this method of cutting is shown in Fig. 17.

The sizing tool, Fig. 6, is shown in use in Fig. 15. After the work has been roughed off to approximately the desired size, the sizing tool is used in making several grooves spaced one or two inches apart and at the diameter wanted. As shown in the illustration, the tool is held in one hand, the handle rests underneath the wrist and forearm and the other hand holds the calipers. One leg of the calipers rests on the work in the groove and as the cut grows deep enough, the calipers are slipped over. After the several grooves are made, the gouge is used to cut the intervening stock to within a sixty-fourth and then the chisel is used to finish the cut if it is in a straight line.

The sizing tool and chisel are held in line with the axis of the work when turning, that is, they point toward the center. Most workmen prefer using the round nose, shown in Fig. 9, when making grooves, fillets, etc. It is less dangerous to use than the gouge. Grooves are easily turned with the round nose. Marks are made on the revolving work denoting the width of the groove, usually by the points of a divider. The smallest diameter is found by using the calipers as when using the sizing tool. This manner of holding the sizing tool or round nose is governed by the size of the work. If the work is large, the lathe must be stopped to measure, since in that case, two hands are used with the sizing tool.

When making a fillet, the wood is turned down to the size at the bottom and top and then the round nose is used to cut the curve. Fig. 18 shows the dividers marking the groove and the square shoulder for the fillet.

The spear point Fig. 8 is used in roughing cuts such as cutting down the square of the fillet before using the round nose. It is used for turning up large face plate patterns, but more often is used in cutting the sides of a square groove or in boring out inside work and trimming the ends of prints.

Figs. 10 and 11, the right and left skews, simply are scraping chisels with the edges angled for the purpose of finishing up in corners and angles. Fig. 4, the hustler chisel is used for cutting off and for sizing. The two projecting edges cut the wood first making grooves and the stock in between is taken off by the cutting portion between the two edges.

Fig. 5 is the tooth plane iron and is used for facing segment work. It is often difficult to face such work straight with a straight chisel on account of the grain of the wood, the glued joints and the vibration which are set up. As the tooth plane tool is made up of a number of teeth, each tooth enters the wood easily as they do not dig in and out like a chisel. Some claim that the small grooves made by the tooth plane makes a better glue joint.

The tool shown at Fig. 19 makes a finish which is inferior only to that made by the double skew chisel and is much safer in inexperienced hands. It is especially useful when turning small spindles. It requires less pressure against the work than a square chisel or an ordinary round nose, since it is hollow ground and presents a longer taper to the cutting edge and cuts the work smoothly.

WHAT OTHERS ARE THINKING

Abstracts Selected from the World's Foundry Literature

Sodium Silicate Stops Leaks

Impregnating Aluminum Castings with Silicate of Soda, anonymous, *Metal Industry*, London, Jan. 28, 1927. Aluminum castings which are used on gasoline or oil lines sometimes leak owing to the ability of the liquid to find its way through minute pores. This porosity is claimed to be combated successfully by impregnating the castings with sodium silicate in an apparatus which is evacuated, filled with solution and a pressure of 300 pounds per square inch is applied in sequence. The apparatus consists of two steel bottles of approximately 763 cubic inches and 1050 cubic inches capacity, and known as the impregnating and feeder bottles, respectively. The two bottles are placed parallel in the vertical plane, and cross connected at the bottom by a ¾-inch pipe containing a valve. The impregnating bottle is fitted at the top with a removable flanged head which has two fittings; one of which leads to a vacuum and pressure gages, and the other to the vacuum pump line. An offset on the vacuum line leads to the pressure pump. Valves are interposed so that either pump may be used.

The method used was to take the rejected castings and clean them well to remove all foreign matter. The solution of sodium silicate is heated to 190 degrees Fahr. The impregnating bottle also is heated to prevent chilling the solution. Castings are placed in the impregnating bottle and the cap flange drawn up tightly. The vacuum line is then opened and when the gage shows 25 inches of vacuum, the line from the feeder bottle is opened and the solution allowed to fill the impregnating bottle. Meanwhile pressure is built up in that line and after closing the vacuum line valve, the pressure valve is opened and a pressure of 300 pounds per square inch built up in the impregnating bottle. This is held for one hour, then the castings are removed, thoroughly washed and dried. An air pressure test of 30 pounds and of gasoline, 100 pounds showed no leaks in the castings.

Describes Modern Apparatus

Scientific Methods Practiced in Modern Foundries, by J. M. Espana, *La Fonderie Moderne*, Paris, December, 1926.

This is a paper presented by M. Espana before the Barcelona section of the Association of Industrial Engineers of Spain. It consists of a review of the principal scientific methods, machines and instruments in the modern foundry. The author describes various testing machines for shearing, bending, shock and compression tests, also methods of testing the quenching of malleable iron and for testing the capacity of the molten metal to fill the mold. This is followed by the description of a special siphon process used in certain cupolas. The tapping hole is closed with a brick in which are three holes one above the other. When the molten metal appears at the lower hole, this is closed with a plug of clay; the metal rises to the second hole and when it comes through this also is closed; finally the metal runs through the upper hole. If the blast is suddenly cut off there is a decrease in the pressure inside the cupola and the level of the metal inside the cupola rises while the siphon effect automatically stops the flow of the metal through the tapping hole. The paper deals with pyrometers, the necessity of an instrument especially adapted for foundry work being emphasized. An instrument for testing the degree of ramming of the sand in moulds is described. The author mentions the practice of effecting additions of ferrosilicon and ferromanganese to the charge or in the ladle. He also emphasizes the necessity of a laboratory both for chemical analysis and physical tests.

Lowers Iron in Slag

The Relation between Melting Temperature and Lime Additions on the Iron Content of Cupola Slag, by E. Diepschlag, *Die Giesserei*, Nov. 6, 1926. Efforts to increase the melting temperature in cupolas without increasing the amount of coke has aroused the question whether the oxidation of iron increases or decreases with higher temperatures. An experiment to solve this problem has been carried out and the results are interesting.

To get accurate results concerning the relationship between FeO in slag and melting temperature, it was necessary to determine the weight of iron and slag discharged and then calculate the percentage of FeO with respect to 1 kilogram of charged iron. From the results derived from about 60 determinations, it was found that the amount of FeO in the slag was considerably less at higher temperatures than with lower temperatures. The average was 0.95 per cent at 1450 degrees Cent. Therefore, it is believed that the burning off of iron decreases with increasing temperatures.

As known from other metallurgical processes it is possible to reduce the ferrous oxide (FeO) in slag by increasing the temperature and adding lime (CaO). The latter has the same effect in the cupola, but only to a certain extent. The experiment carried on shows clearly, contrary to others, that the FeO content in high lime slag increases with high temperatures. The reason for this probably is that pure lime slag obtained through high temperature becomes viscous and ceases to protect the molten iron against oxidation. Fluorspar has been added to get a more liquid slag and it was found that by keeping the slag liquid, the burning off of iron was reduced. Conclusions drawn are that the oxidation of iron when high melting temperatures are employed is dependent on the chemical processes involved and the physical properties of the slag.

Train Apprentices

The Organization of Apprenticeship in a Foundry, by F. Aubry, *La Fonderie Moderne*, Paris, December, 1926.

In this paper presented at a meeting of the Association Technique de Fonderie de Paris, the author discusses the problem of obtaining apprentices in the foundry. He admits that it is especially difficult to recruit apprentices as molders and suggests offering them a slightly higher salary than that of apprentices in the specialty departments. At the Fonderies de Brousseval, Haute-Marne, boys aged from 13 to 18 years can be molder apprentices; this is rendered possible in France since the 8-hour day is applied. The author summarizes the course of studies which is divided into two sections, one of general and supplementary classes, the other of technical and specialized classes. The course is of three years' duration. When the course is completed, it is suggested that a bonus be paid at the end of the course, another bonus a year afterward and another two years later, to encourage the workers to remain with the concern that has been responsible for their instruction. The author emphasizes the necessity of giving practical instruction to the apprentices in the foundry and commends the practice of giving the young molders an opportunity to work on actual orders. The various competitions, examinations and the control of the course, as followed at Brousseval are explained by the author.

Shrinkage Causes Defects

Shrinkage or Blisters, by Felix Henon, *Fonderie Moderne*, October 1926. Exception is taken to J. Leonard's theory that most defects are due to the release of gases. The author endeavors to prove that in many cases the defect is due to shrinkage. In order to counteract these effects it is suggested to accelerate the cooling at the points where the defect has been observed, to decrease the resistance of the mold to compression when shrinkage takes place, to modify when possible the shape of the casting, to reduce as far as practicable the differences in section, and to have heads above the massive parts in order to maintain them in a liquid state while shrinkage takes place at the extremities. The need for a standard list of terms for the various defects in castings is emphasized to considerable extent.

The Shakeout

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PAT DWYER, Engineering Editor
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CHARLES VICKERS, Nonferrous Editor
EDWIN BREMER, Associate Editor

¶ Paying for Dead Horses

HOW far does the foundry's responsibility go? It generally is believed and assumed that the foundry is responsible to the customer in replacing a defective casting. No reputable foundryman knowingly would supply a customer with a casting that he believed not standard in every way, because he could not afford to lose his customer's confidence. However, a recent decision in the English courts will give all foundrymen food for thought. Justice Roche in the case of J. Gordon Alison & Co. Ltd. vs. Wallsend Slipway & Engineering Co. Ltd. decided against the defendants. The plaintiff is a ship repair company and the defendant an engine builder, and the case involved an intermediate cylinder which the latter supplied. This cylinder when tested was found to be partly defective, but it was believed that with certain repairs it could be used until a new one could be cast. However, upon further examination it was found that other cracks appeared and the inspectors condemned it. Consequently, the ship could not proceed upon its journey and the ship owners sued the ship repairers for approximately $22,356 which was settled for about $20,898. The ship repairers or J. Gordon Alison & Co. in turn sued the Wallsend company for this sum and won its case.

THE judge gave a learned discourse on the defects and their causes and seemed to have an excellent understanding of the subject. He gave it as his opinion that due to some neglect or haste in making the casting, the defendant was responsible for the defects that appeared, even though they were not noticeable when the casting was shipped. Even then the defendant would not have been liable except that the judge upheld the plaintiff in that the usual red ink clauses headed, "All offers are subject to our usual strike and guarantee clauses, accidents, etc." did not state definitely that the defendant only was responsible to the extent of replacing the casting.

Should this decision be upheld in the higher courts, foundrymen may be held responsible for all sorts of damages if it can be shown that the casting supplied was defective. Therefore, the foundryman should see that all contracts bear in no uncertain terms that his responsibility is only to the extent of replacing the defective castings.

¶ Tell the World

A VALUABLE lesson may be learned by the foundrymen of America through a study of sales methods which have been developed and practiced by several important industrial groups during the past few years. Facts of a campaign which has been waged by the National Paint & Varnish association were told recently by Ernest T. Trigg, president John Lucas & Co. Inc., Philadelphia, at a Cleveland gathering, and are worth careful consideration.

In 1921, that organization set out deliberately to put on an intelligent campaign for trade extension. Members of the association at that time, when general business conditions were at a low point, undertook to double the volume of sales of the paint and varnish manufacturers in five years. However, the campaign was so successful that the goal was reached in four years.

METHODS used in the movement to increase sales are interesting. The national advertising campaign carrying the slogan *Save the surface and you save all* has carried the message of the paint and varnish manufacturer to the far corners of the earth. An educational bureau was organized to assist in spreading the value of paint as a preservative. Through the educational work the standing of the industry was placed on an exceptionally high plane.

Perhaps the time will come when foundrymen will unite to tell the world that they are manufacturing a high quality product which is essential in the lives of every individual. Such a combination would go far in stamping out the injurious propaganda which has been and is being circulated concerning the substitution of fabricated articles for castings. The industry needs educational and sales campaigns.

Trade Trends in Tabloid

CASTINGS orders are showing some increase with the advance of the spring season. Automotive jobbing foundries are becoming increasingly busy. Stove and furnace work, while not as heavy as during the closing months of last year is satisfactory. General jobbing gray iron foundries in the central west report slight improvement. Miscellaneous steel castings demand is good, but railway foundries still are far from capacity. While the railroads in 1926 carried the heaviest traffic in their history and while car buying was active in January, a decline was noted during February and the early part of March. The total of freight car orders placed last month was only about half of the preceding month. Although the total production of pig iron in February, as reported by *Iron Trade Review* was 2,940,823 tons, as compared with 3,101,346 tons in the preceding month, the total of merchant iron showed a more decided decline. The merchant iron made last month totaled 654,008 tons compared with 745,766 tons for January. The short month accounted in some measure for this loss. Average New York prices for nonferrous metals in February, according to *Daily Metal Trade* follow: Casting copper, 17.25c, electrolytic copper, 12.-934c; Straits tin, 69.456c; lead, 7.48c; antimony, 14.506c, aluminum, foundry ingot, 25.775c. Zinc averaged 6.688c, E. St. Louis, Ill.

RAW MATERIAL PRICES

Iron

March 8, 1927

No. 2 foundry, Valley	$18.00 to 18.50
No. 2 southern Birmingham	18.00
No. 2 foundry, Chicago	20.00
No. 2 foundry, Philadelphia	21.41 to 22.26
No. 2 foundry, Buffalo	18.00 to 18.50
Basic, Valley	18.00 to 18.50
Basic, Buffalo	18.00 to 18.50
Malleable, Chicago	20.00
Malleable, Buffalo	18.00 to 18.50

Coke

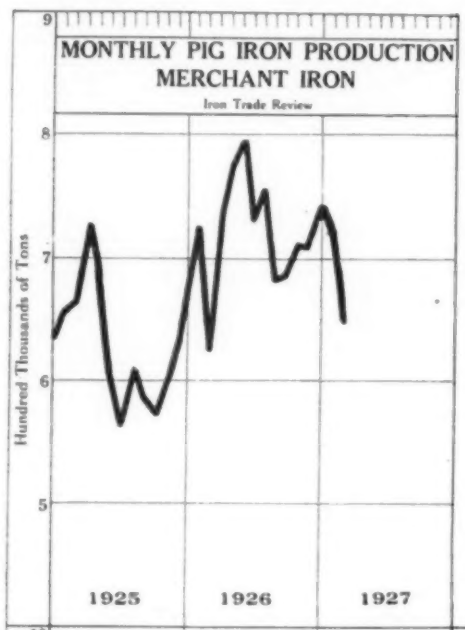
Connellsville foundry coke	$4.00 to 4.75
Wise county foundry coke	6.00

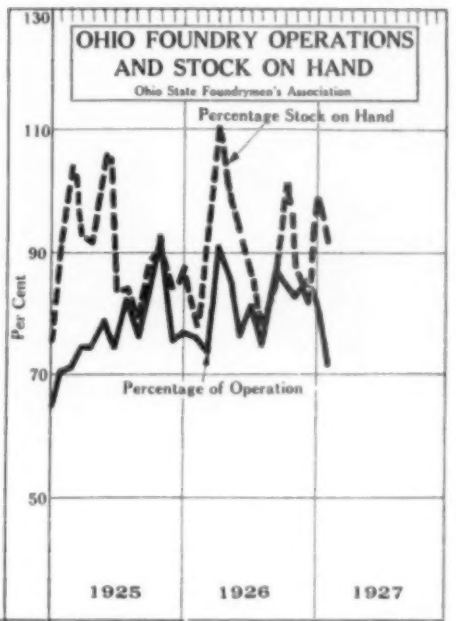
Scrap

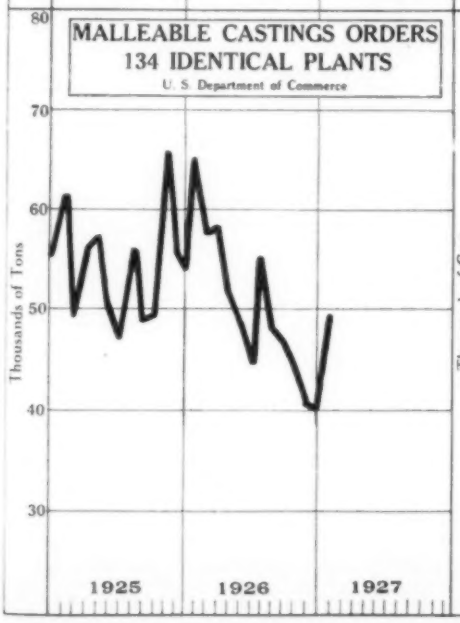
Heavy melting steel, Valley	$17.00
Heavy melting steel, Pitts.	16.00 to 16.50
Heavy melting steel, Chicago	13.00 to 13.25
Stove plate, Chicago	14.00 to 14.50
No. 1 cast, New York	14.00 to 14.50
No. 1 cast, Chicago	16.50 to 17.00
No. 1 cast, Philadelphia	17.00 to 18.00
No. 1 cast, Pittsburgh	15.50 to 16.00
No. 1 cast, Birmingham	15.00 to 16.00
No. 1 cast, Buffalo	16.00 to 16.50
Car wheels, iron, Pittsburgh	16.00 to 16.50
Car wheels, iron, Chicago	15.00 to 15.50
Railroad malleable, Chicago	16.00 to 16.50
Agricultural mal., Chicago	15.25 to 15.75
Malleable, Buffalo	17.00 to 17.50
Railroad malleable, Pitts.	16.00 to 16.50

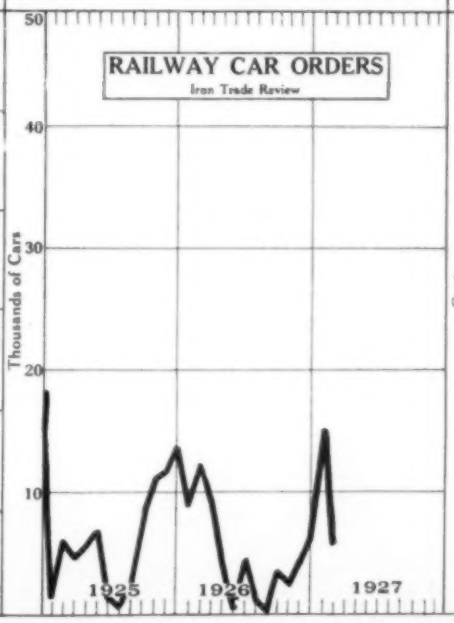
Nonferrous Metals

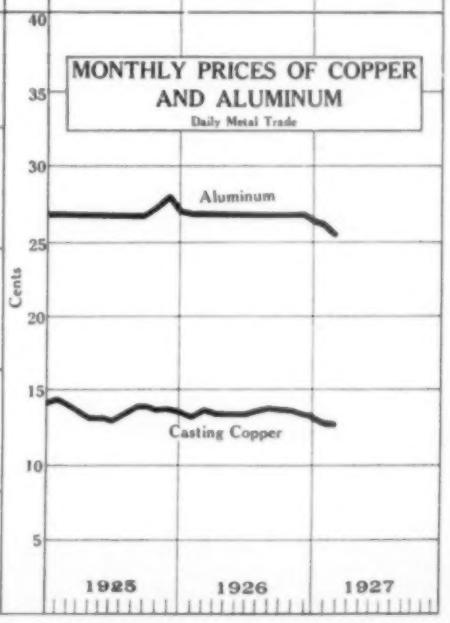
	Cents per pound
Casting copper, refinery	13.10
Electro copper, producers	13.37½
Straits tin	70.00
Lead, New York	7.65 to 7.70
Antimony, New York	12.75
Nickel, electro	39.00
Aluminum, No. 12, prod'rs	24.50
Aluminum, No. 12 remelt	20.50
Zinc, E. St. Louis, Ill.	6.80 to 6.85











Comings and Goings of Foundrymen

ARTHUR SIMONSON recently has been elected vice president of the Falk Corp., Milwaukee. Mr. Simonson was born in Sheffield, Eng., and was educated in the public schools of that place and in the Sheffield Technical school. He served his apprenticeship in the steel foundry department of Edgar Allen & Co. Ltd., Sheffield. In 1900 Mr.

ARTHUR SIMONSON

Simonson came to the United States as representative of Alexander Tropenas, inventor of the side-blown converter, and installed a number of these furnaces in various plants. Later he was general foundry superintendent of William Wharton Jr. & Co. Inc., Philadelphia. Since 1910 Mr. Simonson has been connected with the Falk Corp. in various capacities in the steel foundry. He has been sales manager of the steel foundry department of the firm since 1916.

H. H. Nott, Smith System Heating Co., Minneapolis, recently elected president of the Twin City Foundrymen's association, Minneapolis, received his education in the schools of that city and began working for the A. Guthrie Co., St. Paul where he spent three years. Following this he was connected with the Minneapolis Steel and Machinery Co. for two years. Mr. Nott next was associated with Waterman-Waterbury Co., Minneapolis as general purchasing agent. Five years ago he became connected with the Smith company as general purchasing agent and assistant superintendent of the foundry department.

Louis Powelk has been appointed foundry superintendent of the Chicago Steel Foundry Co., Chicago. Prior to his connection with this firm, he was foundry superintendent for Burnside Steel Co., Chicago and before that was assistant superintendent for the Michigan Steel Castings Co., Detroit.

J. J. Jordan has been placed in charge of the new foundry which is nearing completion at the Massachusetts State prison, Charlestown, Mass. Previous to his present position Mr. Jordan was in charge of the foundry of Levering Bros., Baltimore, and before that was associated for 12 years with the King's County Iron Foundry Co., Brooklyn, N. Y. Mr. Jordan is a brother of Pat Jordan, Mansfield Foundry Co., Mansfield, Mass., who for many years has been prominent in New England foundrymen's circles.

John E. Galvin, president of the Ohio Steel Foundry Co., Lima, O., and a director of the American Foundrymen's association was elected president of the Lima Manufacturers' association. L. A. Larsen, vice president and treasurer of the Lima Locomotive Works Inc., was elected secretary and treasurer, and E. N. Pierce, secretary and assistant treasurer of the Lima Locomotive Works Inc., was named assistant secretary and treasurer.

D. L. Mathias, editor of *Forging-Stamping-Heat Treating* since November, 1922, and also editor of *Blast Furnace and Steel Plant* for the past year, resigned Feb. 12 to accept a position with Mackintosh-Hemphill Co., Pittsburgh, as a metallurgical engineer. Mr. Mathias has had considerable experience in this work, as he served in a similar capacity with Mackintosh-Hemphill Co. from 1914, after graduation from the Carnegie Institute of Technology, until 1920. He was associated also with the Brown Instrument Co., Philadelphia, as a pyrometer engineer. In addition to his duties as metallurgical engineer, he will have charge of publicity and advertising for the Mackintosh-Hemphill Co. Mr. Mathias is a member of the American Society for Steel Treating and the American Society for Testing Materials.

Albert N. Wallin, who has been selected secretary-treasurer of the Chicago Foundrymen's Club, enjoys a wide acquaintance among foundries and foundrymen in Chicago and in surrounding territory. As a sales

ALBERT N. WALLIN

representative in the Chicago district for the S. Obermayer Co., foundry equipment and supplies, Mr. Wallin has familiarized himself with the industry through more than 15 years of contact. A native Chicagoan, Mr. Wallin began his service with the Obermayer company more than 20 years ago as an office boy, immediately after leaving the public schools.

J. Ramsey Speer was re-elected president of the Mackintosh-Hemphill Co., Pittsburgh at the annual stockholders' meeting. F. H. Moyer, vice president, D. H. Baum, secretary and treasurer and James C. McFee assistant secretary, were other officers returned.

E. S. Black has rejoined the American Manganese Steel Co., Chicago Heights, Ill., with his headquarters at the home offices. His new duties will be in connection with mechanical and sales consulting engineering practice. A. H. Exton also has rejoined

the American Manganese organization. He will hold the position of chief engineer.

E. C. Andrews, president of the Niagara Radiator & Boiler Co., and the Jacob Dold Packing Co., Buffalo, sailed recently for England.

Southern Metal Trades Group Meets

A joint meeting of the North and South Carolina divisions of the Southern Metal Trades association recently was held at Salisbury, N. C. A paper prepared by Mr. McCuiston, a vice president of the association, on forms of cost accounting was read and discussed by the members.

Inaugural Meeting Held

Society of Time Study Engineers, Detroit, recently held its monthly dinner meeting at the Savoy hotel. J. W. Morrison, industrial engineer, spoke on the subject of qualifications of a time study engineer. Officers were installed and are as follows: J. C. Mottashed, Hudson Motor Car Co., president; Harry Ford, Cadillac Motor Car Co., vice president; A. C. MacClure, Hudson Motor Car Co., secretary and treasurer.

Interiors of iron pots used for melting aluminum may be coated with thin dressing of graphite wash followed by a thin coat of whiting and water glass.

Obituary

Justus H. Schwacke, who retired as president of William Sellers & Co. Inc., Philadelphia, May 31, 1926, died in Boca Grande, Fla., Feb. 16, following a stroke. He was born 79 years ago and had been with the Sellers company continuously from July 15, 1862, until his retirement. He took part in the organization of numerous associations including the National Metal Trades association of which he was president in 1910. He was an active member of the National Founders association and the National Association of Manufacturers and had been president for several years of the Metal Manufacturers association, Philadelphia. He was a member also of the Machinery club, New York, and the Art club, Philadelphia. He was succeeded as head of William Sellers & Co. Inc. in 1926 by Alexander Sellers.

George R. Nixon, secretary and director of the Continental Heater Corp., Dunkirk, N. Y., died Feb. 17 in New York.

Edward I. Braddock, an inventor and metallurgist and former resident of Winchester, Mass., died recently in Cleveland Heights, O. He was prominent in machine manufacturing in New England 15 or 20 years ago. He developed many processes of tinning, galvanizing and similar lines.

John Keffe, 72 years old and organizer of the Anderson Stove Co., Anderson, Ind., died recently at Hollywood, Calif. At the time of his death he was secretary-treasurer of the company and had been spending the winter on the west coast. Mr. Keffe was born in Ireland and came to America when a boy.

Joseph Horner, well known for many years as a contributor to THE FOUNDRY on pattern shop and foundry practice subjects, died recently at his home in Bath, Eng.

Starts Operations

The Binney Castings Co. has been established at 1805 Clinton street, Toledo, O. This organization is headed by R. L. Binney who for eight years was chief metallurgist of the Bunting Brass & Bronze Co. of that city. The new foundry has been engaged for some time in experimental work and expects to enter production on various nonferrous alloys including a special bronze for glass molds and a long life gear metal.

Publishes Bulletin

The University of Michigan, Ann Arbor, Mich., has published a 40-page bulletin describing its programs in chemical, metallurgical, and other allied engineering courses. Facilities for instruction and research are given with other pertinent data on the required subjects.

Foundry Association Directory

American Foundrymen's Association

President, S. W. UTLEY, Detroit Steel Casting Co., Detroit; secretary-treasurer, C. E. HOYT, 140 South Dearborn street, Chicago; technical secretary, R. E. KENNEDY, 909 W. California street, Urbana, Ill.

The Buffalo Foundrymen
Buffalo

President, J. MCARTHUR, Washington Iron Works; secretary W. J. WARK, E. J. Woodison Co., 146 Chandler street. Meetings the third Wednesday of the month at 146 Chandler street.

Chicago Foundrymen's Club
Chicago

President, G. H. ROLINSON, American Brake Shoe & Foundry Co., Chicago. Meetings second Saturday in each month at the City club, 315 Plymouth court.

Connecticut Foundrymen's Association

President, FRED W. STICKLE, Capitol Foundry Co., Hartford, Conn.; secretary, C. S. NEUMANN, Union Mfg. Co., New Britain, Conn. Meetings are on second Friday of each month in various parts of the state.

Detroit Foundrymen's Association
Detroit

President, ROBERT G. CRAWFORD, Atlas Foundry Co., 131 South Artillery street, Detroit; secretary, RUSSELL M. SCOTT, Packard Motor Co., 1580 East Grand boulevard, Detroit. Meetings third Thursday in each month at the Union League club, 35 Grand River avenue, Detroit.

Metropolitan Brass Founders' Association
New York

President, WILLIAM EMBER, Jefferson Brass Foundry, 62 Delevan street, Brooklyn, N. Y.; secretary WILLIAM E. PAULSON, Thomas Paulson & Son Inc., 97 Second avenue, Brooklyn, N. Y. Meeting second Wednesday in each month at the Building Trades club, 34 West Thirty-third street, New York.

Newark Foundrymen's Association
Newark, N. J.

President, J. L. CARTER, Barlow Foundry Inc., Newark; secretary, W. H. MANTZ, Atlas Foundry Co., Irvington, N. J. Meeting called by president.

New England Foundrymen's Association

President, HENRY S. CHAFEE, Builders Iron Foundry, Providence, R. I.; secretary, FRED F. STOCKWELL, 205 Broadway, Cambridgeport, Mass. Meetings second Wednesday of each month at the Exchange club, Boston. Outings usually are held in the summer months.

Ohio State Foundrymen's Association

President, WALTER L. SEELBACH, Walworth Run Foundry Co., 2488 West Twenty-seventh street, Cleveland; secretary-manager, ARTHUR J. TUSCANY, 5713 Euclid avenue, Cleveland.

Philadelphia Foundrymen's Association
Philadelphia

President, WALTER WOOD, R. D. Wood & Co., Philadelphia; secretary HOWARD EVANS, Union League club, Philadelphia. Meetings the second Wednesday of each month at the Manufacturers' club.

Pittsburgh Foundrymen's Association
Pittsburgh

President, LAWRENCE V. STEVENS, Locomotive Stoker Co. N. E. Pittsburgh; secretary-treasurer, WILLIAM J. BRANT, Wm. J. Brant, Bessemer building, Pittsburgh. Meeting on the third Monday of the month, except in July and August, at Fort Pitt hotel.

Quad-City Foundrymen's Association
Davenport, Iowa

President, J. H. DIEDRICH, Blackhawk Foundry & Machine Co., Davenport, Iowa; secretary-treasurer, A. D. ZIEBARTH, Davenport Foundry & Machine Co., Davenport, Iowa. Meetings the third Monday evening of each month, the meeting place being rotated between Moline, Rock Island and Davenport.

Southern Metal Trades Association
Atlanta, Ga.

President, GEORGE B. COCKER, Gastonia, N. C.; secretary, W. E. DUNN JR., Healy building, Atlanta, Ga.

Tri-City Technical Council
Moline, Ill.

Chairman, H. BORNSTEIN, Deere & Co., Moline, Ill.; treasurer, MAX SKLOVSKY, Deere & Co., Moline, Ill. Combined meetings held only one or two times a year on call.

Tri-State Foundrymen's Association
Cincinnati

President, HAROLD P. RITTER, John A. Oberhelman Foundry Co., 3323 Colerain avenue; secretary, GEORGE W. PIEHL, Wessling Bros. Foundry Co., 1607 McLean avenue. Meetings the second Thursday of each month at the Cincinnati club, Eighth and Race streets.

Twin City Foundrymen's Association
Minneapolis-St. Paul

President, H. H. NOTT, Smith System Heating Co., Minneapolis; secretary-treasurer, C. E. LANGDON, 3849 Lyndale avenue, So., Minneapolis. Meetings monthly at the Athletic club.

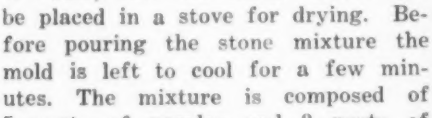
Makes Stone Mixture for Patternmaking

A stone mixture for patternmaking is being manufactured by the Constructional Engineering Co., Ltd., of Birmingham, England. When poured into a mold this material hardens in six to eight hours. The manufacturers claim that it does not contract and that it is worked easily. It is finished with emery paper. Stone patterns made from the mixture may be used in any type of molding machine. By adding the required quantity of material, alterations may be made to the pattern-plate. It is claimed that 40,000 casts may be made from each pattern-plate.

The original mold is made from good quality sand as for an iron or plaster of paris pattern. To prevent porous places the sand is passed through a fine riddle. Projections or high parts are strengthened by nails painted over with an insulating solution if they are to come into contact with the stone mixture. If a metal flask is used it also is painted inside with the insulating solution. The surface of the mold is powdered with insulating powder. The surface is dried, but the mold should not be placed in a stove for drying. Before pouring the stone mixture the mold is left to cool for a few minutes. The mixture is composed of 5 parts of powder and 3 parts of solution which is well mixed. The pouring of the mixture should be done slowly and vertically into one corner of the mold and not moved about over the whole surface. The operation should be carried out in a room or workshop with a normal temperature as cold delays setting.

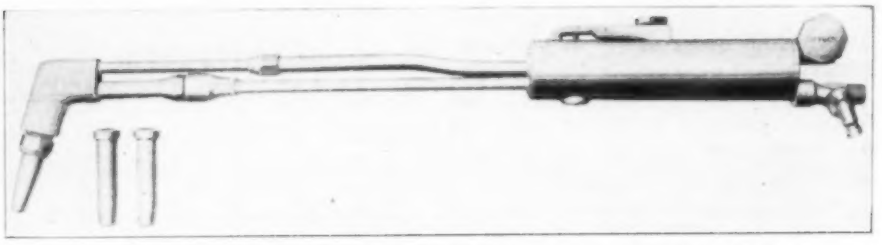
Develops Die Grinder

The United States Electrical Tool Co., 2488 West Sixth street, Cincinnati, recently has placed on the market a portable die grinder. This type is adaptable to work where



THE HANDLE IN THE REAR IS ADJUSTABLE

speed and accuracy are required, including die grinding, grinding fins from light castings, and grinding welded parts. The adjustable back handle, which is shown in the accompanying illustration, permits operation of the tool in close places. The speed load of the tool is 11,000 revolutions per minute and the grinder weighs 12 pounds.



HIGH PRESSURE OXYGEN IS CONTROLLED BY A THUMB VALVE

Operator Controls Ladle With Push Button

The Cleveland Electric Tramrail division of the Cleveland Crane & Engineering Co., Wickliffe, O., recently

ONE MAN HANDLES THE RAISING, LOWERING AND POURING OPERATIONS

has introduced a device which permits one man to lower and raise foundry ladles and pour off. A suitable electric hoist is mounted on the tramrail carriers and is arranged for push button control. The buttons are mounted on the ladle shank, as shown in the accompanying illustration, which literally gives the operator control of the ladle under his thumb.

The control cable is detachable readily from both handle and carrier by a plug and receptacle at each end. The push button is the regular remote control type mounted on a grip which may be detached from the bail.

Uses Illuminating Gas

A new cutting torch which will use either city gas, natural gas or by-product coal gas has been developed by the Alexander Milburn Co., 1416 West Baltimore street, Baltimore. The torch is made of bronze forgings and special seamless tubing and is designed to withstand constant and severe service. The high pressure cutting oxygen is controlled by a thumb valve which remains fixed either in the open or closed position. The torch is supplied with a range of tips to accommodate various thicknesses of metal. The tips are made of solid copper and are designed to preheat the gases rapidly, thus giving better penetration and quicker cutting. A view of the torch is shown in the accompanying illustration.

Foundry Loss Includes Gates and Scrap

Question: From time to time I have read a statement in THE FOUNDRY to the effect that in light and medium weight foundries the recovery of good castings only amounts to 50 to 60 per cent. The castings made in my plant come under the foregoing classification but never have losses approached that figure. For the past 10 years our castings loss will not average 3 per cent. I do not see how a foundry could continue in business with a casting loss of 40 to 50 per cent. Perhaps I do not take the correct meaning from the statement. Kindly enlighten me.

Answer: Like many other statements and terms used in the foundry, the statement to which you refer is rather ambiguous. Literally the meaning is that the weight of good castings is only 50 or 60 per cent of the weight of the metal charged into the cupola. For the time being the weight of the gates, sprues, over iron, spills and scrap castings is ignored. It is only a general statement useful in checking the amount of coke and iron required to produce a definite tonnage of salable castings.

The weight of the various items which go to make up the discrepancy

between the amount of iron charged into the cupola and the amount shipped as cleaned castings varies according to the character of the work handled. For example, the cupola melting loss, that is the amount of iron actually destroyed, will vary from 1 per cent in the case of pig iron to approximately 10 per cent of light steel or iron scrap. On plain simple castings, or even on more complicated castings where trained men are accustomed thoroughly to their production, the volume of scrap castings mey be held down to 3 per cent as in your case. In many shops the percentage is even lower. On certain classes of castings where the specifications are unusually rigid, the rejections may run to 25 per cent. Obviously the amounts of iron which must be melted to fill the gates and runners depends on the character of the castings. On certain classes of light bench work, the amount of iron in the gates will exceed the amount in the castings. On exceedingly large, heavy castings the weight of the gates and risers may not amount to 1 per cent. On open sand castings the amount of iron left in the runners is negligible. When you read that a certain foundry only recovers 50 per cent good castings it means that 5 per cent of the iron charged in the cupola is lost either up the stack or in the dump, 5 per cent is represented by defective castings which of course are not actually lost since they have a scrap value and 5 per cent of the total amount charged finds it way into the pig bed, either as over iron from the ladles or the cupola. This metal also is not lost since it may be remelted. Iron in the gates and sprues in extreme cases will amount to 35 per cent. These various items total 50 per cent of the amount of iron charged and that is what is meant by the statement that the recovery of good casting in light work foundries only amounts to 50 per cent.

Book Review

Proceedings of the American Society for Testing Materials, Vol. 26, in two parts, paper, cloth or half leather, 6 x 9 inches; Part I, 1204 pages; Part II, 691 pages; published by the American Society for Testing Materials, Philadelphia, and each part supplied by THE FOUNDRY, Cleveland, for $6.00, paper; $6.50, cloth; and $8.00 in half leather. In London, 2-3 Caxton House, Westminster, S. W. 1, for 30s; 30s 6d, and 40s respectively.

These volumes contain the annual reports of the committees and the technical papers presented at the meetings of the American Society for Testing Materials during 1926. Part I consisting of 1204 pages contains the annual reports of 38 of the standing committees of the society with discussions thereon at the annual meeting. The committees include those on ferrous metals, nonferrous metals, cement, ceramics, concrete, etc. Methods of testing, 105 tentative standards which either have been revised or presented for the first time, the annual address of the president, Edgar Marburg lecture and the annual report of the executive committee also are included. Part II which is composed of 691 pages contains 48 technical papers with discussions. These contain information on the results of investigations in the field of engineering and other materials.

Faked Foundry Facts

A Shrink Bob

Philadelphians Meet

The regular monthly meeting of the Philadelphia Foundrymen's association was held at the Manufacturers club, Philadelphia, on March 9. H. B. Hanley, Whitehead Bros. Co., Rochester, N. Y., spoke on molding and core sands. An open discussion was held on, "What are the principles of gating a mold; Does linseed or other oils have advantages over gum and flour binders; Is pressure blower preferable to other types for use in iron and brass foundries."

Book Review

Wage Scales and Job Evaluation, by Merrill R. Lott, cloth, 161 pages, 5½ x 8½ inches, published by the Ronald Press, New York, and supplied by THE FOUNDRY, Cleveland, for $5.00, and in London, 2-3 Caxton House, Westminster S. W. 1, for 25s.

The subject of wages is of interest to the worker and the employer. To the worker wages mean livelihood and an opportunity to share in comforts and luxuries. For the employer, wages represent a large part of the cost of carrying on business. The average employer only has the most general understanding of how the payroll should be apportioned among the members of the various trades and occupations represented by his employes, and relies on the law of supply and demand to determine wage scales. This book presents methods for rating employes, establishing standards whereby a differentiation may be made between those who are to receive the highest and the lowest wages for any particular occupation. These methods are said to have been tried out with success in a large manufacturing plant in the East. Methods also are given for determining the wages that shall be allotted to any particular operation. Numerous charts giving the details of the rating systems are shown, and it is stated that the methods may be applied to any plant. The method is said to present a report of the worker's ability which may be used to determine comparative wage scales.

New England Meeting

Members of the New England Foundrymen's association held their monthly meeting at the Exchange club, Boston, on March 9. Blueprints previously were sent out for suggestions on methods of molding, weight estimates, and design of patterns for making a casting in lots of 10 and 100. Replies received were discussed and E. T. Runge, Cleveland, spoke on the method of cost analysis for this work.

Joins Hoist Company

Fred G. Bell, formerly president and general manager of the Zobell Electric Motor Corp., Garwood, N. J., has been appointed to take charge of the co-ordination of motor supply and the electric crane and hoist business of the Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.

What the Foundries Are Doing

Activities of the Gray Iron, Malleable, Steel and Brass Shops

Michigan Foundry & Machine Co. recently has located in Kalamazoo, Mich.

Sladek Pattern Works, Chicago, recently has removed to its new building.

Norton Iron Works, Ashland, Ky., has been acquired by the American Rolling Mill Co., Middletown, O.

Meadows Mfg. Co., Bloomington, Ill., maker of electrically-operated washing machines, plans the erection of a 1-story addition.

Nepperhan Foundry Co., Yonkers, N. Y., will erect a 2-story addition to its plant, at Saw Mill River road.

K. R. Wilson Foundry Co., Arcade, N. Y., will erect a new foundry building 60 x 200 feet on the site of land recently acquired.

Warman Electric Foundry Co., Huntington Park, Calif., manufacturer of electric steel castings will build one or more additions.

It is rumored that the Draper Corp., Hopedale, Mass., and the Hopedale Mfg. Co., Milford, Mass., will merge.

Golden's Foundry & Machine Co., Columbus, Ga., will erect a 5-story pattern storage room, 60 x 68 feet.

Commonwealth Steel Co., Granite City, Ill., will build a 1-story shop 100 x 600 feet for finishing foundry cast locomotive beds.

B. & F. Mfg. Co., L. S. Foerderer, secretary, 2007 Ludlow avenue, Indianapolis, has let the general contract for a 1-story foundry building, 60 x 110 feet, to E. H. Bass. (Noted Feb. 15).

Interstate Foundry & Mfg. Co., Longview, Wash., has awarded the contract for the factory building to be constructed, to L. G. Hauser.

Summit Foundry Co., Barberton, O., has been incorporated with $25,000 and 500 shares no par value, by James Sabo, John Holik, John Benko and Elizabeth Sabo.

Standard Pulley & Mfg. Co., Powers street, Cincinnati, will build a 1-story addition, and has awarded the general contract to Weber-Bell Co., Cincinnati.

Anacortes Foundry Co., Anacortes, Wash., is contemplating the addition of a third unit to the plant and the installation of further material and equipment.

Novelty Iron Works, Sterling, Ill., has awarded the contract for a pattern shop 32 x 50 feet to the Austin Co., 160 North LaSalle street, Chicago. (Noted Feb. 1)

Carthage Machine Co. Ltd., Belleville, Ont., was damaged by fire on Feb. 28. The main molding building and foundry addition were damaged considerably.

Philbrick-Booth Foundry Co., Hartford, Conn., plans to build a 2-story, 60 x 60-foot addition to its plant. Equipment will include a heavy crane.

Arkansas Foundry, 1500 Sixth street, Little Rock, Ark., plans the construction of an addition, and the installation of new equipment and machinery.

George D. Roper Corp., South Main street, Rockford, Ill., manufacturer of pumps and enameled iron products will build a 1-story addition 170 x 170 feet, and a 1-story power plant 38 x 80 feet.

Contracts have been awarded by the Patterson Foundry & Machine Co., East Liverpool, O., for a new $500,000 factory and office building on a recently acquired 2-acre site in the eastern part of the city. The firm now operates two foundry and machine shops in the downtown part of that city which will be located in the new buildings when finished.

Danville Malleable Iron Co., Danville, Ill., has started all three furnaces and increased its working force to 400 men, according to D. E. Willard, president. For the past three months only one furnace has been in operation.

Lansdowne Steel & Iron Co., Lansdowne, Pa., has been incorporated with $6000 capital to manufacture machinery, castings and other devices by L. R. Layton, 132 West Baltimore avenue, Daniel J. Hilferty and Walter H. Howley.

Franklin Engineering Co., Boston, has been incorporated with 1000 shares no par value to manufacture boilers, engines, machinery, tools, castings and other devices, by James A. Galvin, president, Frederick J. McLaughlin, 51 Hampstead road, treasurer, and Frank Murphy.

New Trade Publications

SAND HANDLING—C. O. Bartlett & Snow Co., Cleveland, has published a 20-page catalog showing various types of sand handling apparatus manufactured by the firm. The catalog is illustrated from photographs of actual installations in different types of foundries.

ELEVATORS—Hand-power, revolvable-base elevators for stacking materials are shown in a folder issued by the Revolvator Co., Jersey City, N. J. These elevators are mounted on wheels and may be transported about the shop or warehouse.

AIR COMPRESSORS—Westinghouse Traction Brake Co., Pittsburgh, has published 3 catalogs describing motor-driven air compressors. The compressors are of various sizes to fit any industrial purpose. Constructional features, dimensions, capacities and other data also are given.

STEEL WINDOWS—Mechanisms for opening and closing steel windows in industrial buildings are described in a catalog issued by the Truscon Steel Co., Youngstown, O. These devices are for hand or motor operation and simplify greatly the control of large, continuous-window areas.

TESTING SIEVES—W. S. Tyler Co., Cleveland, has published a 56-page catalog describing sieves for testing purposes. Screen sizes for various tests are presented with suggestions for testing materials.

PERMANENT MOLD—Machines for manufacturing permanent mold castings are shown in a folder issued by the Holley Carburetor Co., Detroit. Molds for different types of castigns are illustrated with estimated production for each.

FOUNDRY FLASKS—Alloy steel flasks for foundry use are described in a catalog issued by the Truscon Steel Co., Youngstown, O. Features of construction are shown by illustrations. These flasks are made in various shapes and sizes to fit the particular type of casting. Bottom boards, core boxes, pouring jackets, and many other foundry appliances also are described.

TRAILERS—Clark Tructractor Co., Buchanan, Mich., has issued a catalog of its trailers for industrial haulage with tractors, showing various types for different uses and details of construction and operation. It is well illustrated.

CONVEYOR CHAIN—An attractive leaflet is being put out by the Farrell-Cheek Steel Foundry Co., Sandusky, O., calling attention to its conveyor chain of special steel to withstand unusual stresses, and designed to give free-running service.

STOKERS—A leaflet by the Flynn & Emrich Co., Baltimore, suggests that stokers must be efficient to bring expected savings in fuel costs and offers service to determine their condition.

RIDDLES—Motor driven and hand operated, portable riddles are shown in a folder published by the Adaptable Molding Machine Co., Birmingham, England. The riddle rides on a rocker frame which is connected to a flywheel that keeps the riddle oscillating.

STAINLESS IRON—Bethlehem Steel Co., Bethlehem, Pa., has issued a booklet giving the properties, composition and application of stainless iron and steel of its manufacture. Instructions for working both metals and sizes of the metals are given.

LETTERS AND FIGURES—Pattern letters and figures of various sizes and styles are shown in a catalog issued by H. W. Knight & Son, Seneca Falls, N. Y. A sample board of aluminum containing 25 different styles in half inch sizes aids considerably in selecting the style of letter for the purpose in hand.

SILICA SAND—A description of the physical properties and other data on the use of silica sand for foundry cores are given in a pamphlet issued by the Standard Silica Co., Chicago.

CONTROL APPARATUS—Allen-Bradley Co., Milwaukee, his issued a number of loose-leaf sheets and catalogs describing various types of electrical controlling apparatus. These types include direct current contactor, resistance starters, slip ring motor starters, across the line starting switches, etc.

TUMBLING MILLS—Round and square, roller bearing equipped tumbling mills are described in a pamphlet published by the Royersford Foundry & Machine Co., Royersford, Pa. Specifications and features of construction are given.

PYROMETERS—Taylor Instrument Co., Rochester, N. Y., has published a catalog devoted to the uses of pyrometers in industry. Various types of instruments are described, methods of installation and care are given. A number of accessories also are included.

PULVERIZED COAL—Data on the use of powdered coal systems in firing malleable furnaces is presented in a 32-page catalog published by the Grindle Fuel Equipment Co., Harvey, Ill. Comparative cost figures and a description of the apparatus manufactured by the company are included.